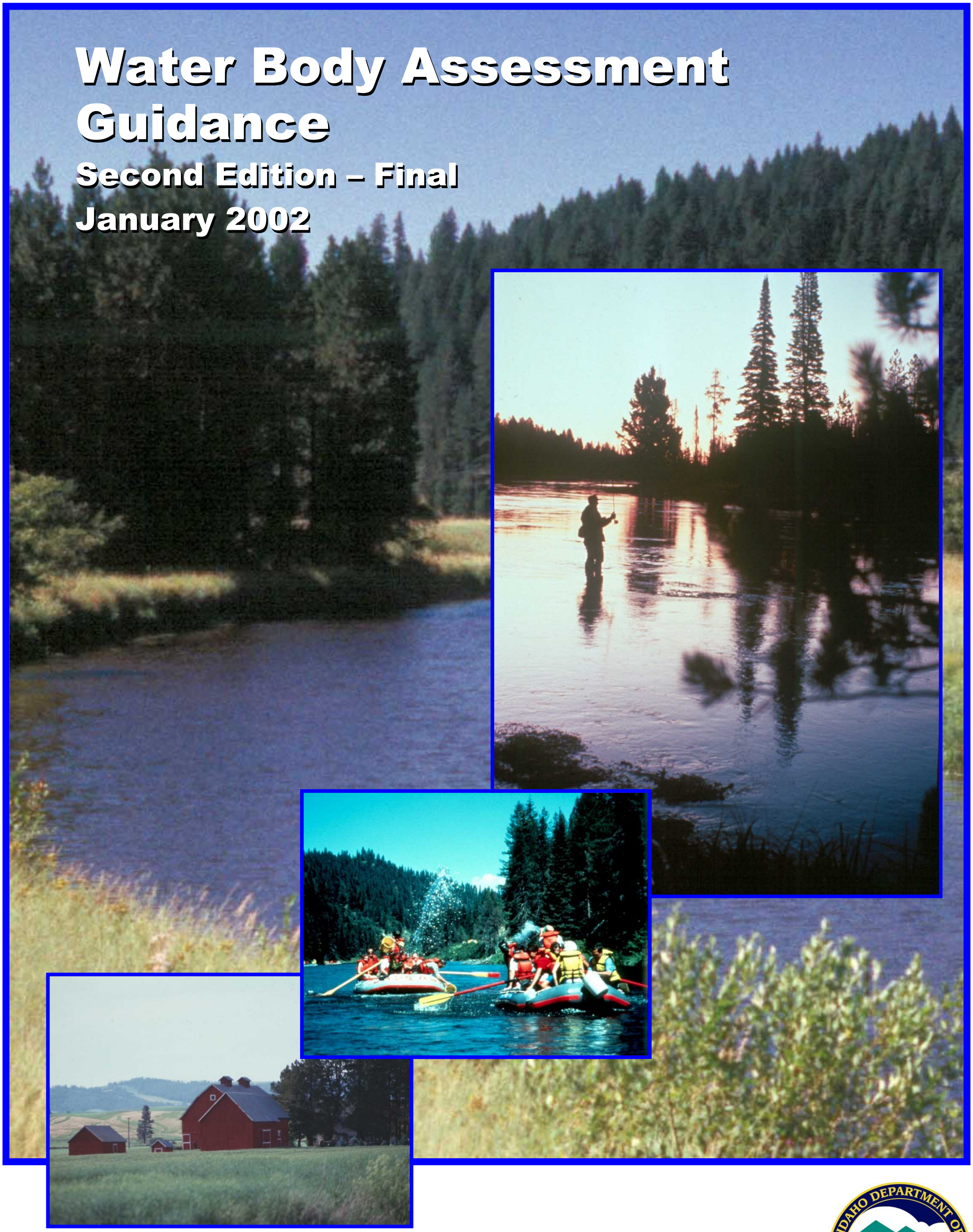
Water Body Assessment Guidance

Second Edition – Final

January 2002



Idaho Department of Environmental Quality

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Acronyms

Acronym	Explanation
ALUS	Aquatic Life Use Support
BURP	Beneficial Use Reconnaissance Program
Cfs	Cubic feet per second
CWA	Clean Water Act
CW ALUS	Cold Water Aquatic Life Use Support
CWE	Cumulative Watershed Effects
DE	Discrimination efficiency
DEQ	Department of Environmental Quality
DO	Dissolved oxygen
EMAP	Environmental Monitoring and Assessment Program
EPA	Environmental Protection Agency
fs	Feet per second
GIS	Geographic Information System
GPS	Global Positioning System
HUC	Hydrologic unit codes
IDFG	Idaho Department of Fish and Game
ISU	Idaho State University
m	Meter
MDAT	Daily Average Temperatures
MDMT	Daily Maximum Temperatures
mg/l	Milligrams per liter
mm	Millimeter
MWMT	Maximum Weekly Maximum Temperatures

Acronym	Explanation
NA	Not assessed
NAWQA	National Water Quality Assessment
NCDC	National Climatic Data Center
NFS	Not fully supporting
ORW	Outstanding Resource Water
PFC	Proper Functioning Condition
QA	Quality assessment
QC	Quality control
RBP	Rapid Bioassessment Protocol
RDI	River Diatom Index
RFI	River Fish Index
RMI	River Macroinvertebrate Index
RPI	River Physicochemical Index
SCR	Secondary Contact Recreation
SFI	Stream Fish Index
SHI	Stream Habitat Index
SMI	Stream Macroinvertebrate Index
SRW	Special Resource Waters
TDG	Total dissolved gas
TMDL	Total maximum daily load
USGS	United States Geological Survey
WBAG	Water Body Assessment Guidance
WBID	Water Body Identification System
WQS	Water Quality Standard

Executive Summary

This Water Body Assessment Guidance (WBAG) is intended as an analytical tool to guide individuals through a standardized assessment process. The WBAG describes Idaho Department of Environmental Quality (DEQ) methods used to evaluate data and determine beneficial use support of Idaho water bodies. This document is a revision of the 1996 WBAG (DEQ 1996).

A water body assessment entails analyzing and integrating multiple types of water body data to address three primary objectives.

- Determine the beneficial use support of a water body.
- Determine the degree of biological integrity.
- Compile descriptive information about the water body.

The regulatory context of the assessment process and how these rules, regulations, and policies are related to DEQ reporting requirements are discussed in Section 1. The Clean Water Act and Idaho water quality standards drive the assessment process and DEQ reporting requirements for the 303(d) list, 305(b) report, subbasin assessments, and legislative reports.

Section 2 discusses how DEQ collects, analyzes, and manages DEQ data used in the assessment process. This section describes the Beneficial Use Reconnaissance Program (BURP) and trend monitoring network. This also includes the methods used to stratify (classify data by stream order and land use) and compare the data for use support determination. Additionally, Section 2 explains the Idaho Water Body Identification System (the scale used to define Idaho water bodies) and the DEQ method used to distinguish between streams and rivers (water body classes for bioassessment).

In Section 3, the WBAG provides guidance on how to identify beneficial uses for assessment purposes. For designated waters, the assessor simply looks to the Idaho water quality standards. However, for undesignated waters, DEQ identifies beneficial uses for assessment based on existing data. Actual subsequent use designations may be different, depending upon additional information that may be received following the procedures described in Idaho Code and water quality standards.

In Section 4, the DEQ policy concerning when and how data from sources other than BURP may be used in water body assessments is discussed. All data are evaluated based on scientific rigor and relevance criteria. Tier I data, that is BURP compatible, is incorporated directly into the appropriate aquatic life assessment index.
Non-BURP compatible Tier I data may also be used for 303(d) listing or delisting purposes, if it meets DEQ data policy requirements set forth in this section.

DEQ uses Tier II data for 305(b) reporting and subbasin assessments, and Tier III data for planning purposes.

The interpretation of numeric or narrative criteria exceedances is explained in Section 5. Narrative criteria are largely evaluated based on the DEQ bioassessment process. A violation of numeric criteria for dissolved oxygen, pH, turbidity, temperature, and total dissolved gas occurs when more than 10 percent of the measurements are above the numeric criteria. DEQ considers climatic conditions, natural background, and species-specific spawning time periods when evaluating whether 10 percent or more of the temperature measurements are above the numeric criteria.

Section 6 explains how DEQ uses multimetric indexes to determine aquatic life use support. DEQ uses different indexes depending on whether the water body is classified as a stream or river. The Stream Macroinvertebrate Index, Stream Habitat Index, and Stream Fish Index comprise the stream indexes; the river indexes consist of the River Macroinvertebrate Index, River Diatom Index, and River Fish Index. Supporting technical analyses for these documents are found in the *Idaho Stream Ecological Assessment Framework* (Grafe 2002b) and *Idaho River Ecological Assessment Framework* (Grafe 2002c) documents distributed separately from this WBAG.

DEQ uses the integrated results from the appropriate multimetric indexes to evaluate subcategories (cold water aquatic life and salmonid spawning) of the aquatic life beneficial use. DEQ applies appropriate numeric criteria separately for cold water aquatic life and salmonid spawning before formulating a final aquatic life use support determination.

How DEQ uses bacteria and toxic data to assess contact recreation beneficial use support is described in Section 7. DEQ uses the geometric mean of bacteria data to determine if water quality standards for primary or secondary contact have been violated. When no data are available, DEQ may evaluate the potential risk for a violation in determining use support.

In Section 8, how DEQ uses toxics data to evaluate domestic, agricultural, and industrial water supplies is discussed. In general, DEQ presumes these uses are fully supporting unless there is evidence to the contrary. This policy is similarly applied for wildlife habitat and aesthetics, as explained in Section 9.

Section 10 attempts to further explain the assessment process through the use of an example. The policies and methods described in Sections 2 through 7 are illustrated in this example. In Section 11, how the public may appeal use support determinations is discussed. The public may petition against assessment determinations during appropriate 303(d) listing or subbasin assessment public comment periods. DEQ will review the appeal and respond accordingly.

Section 1. Water Body Assessment Guidance Overview

1.1. Intent

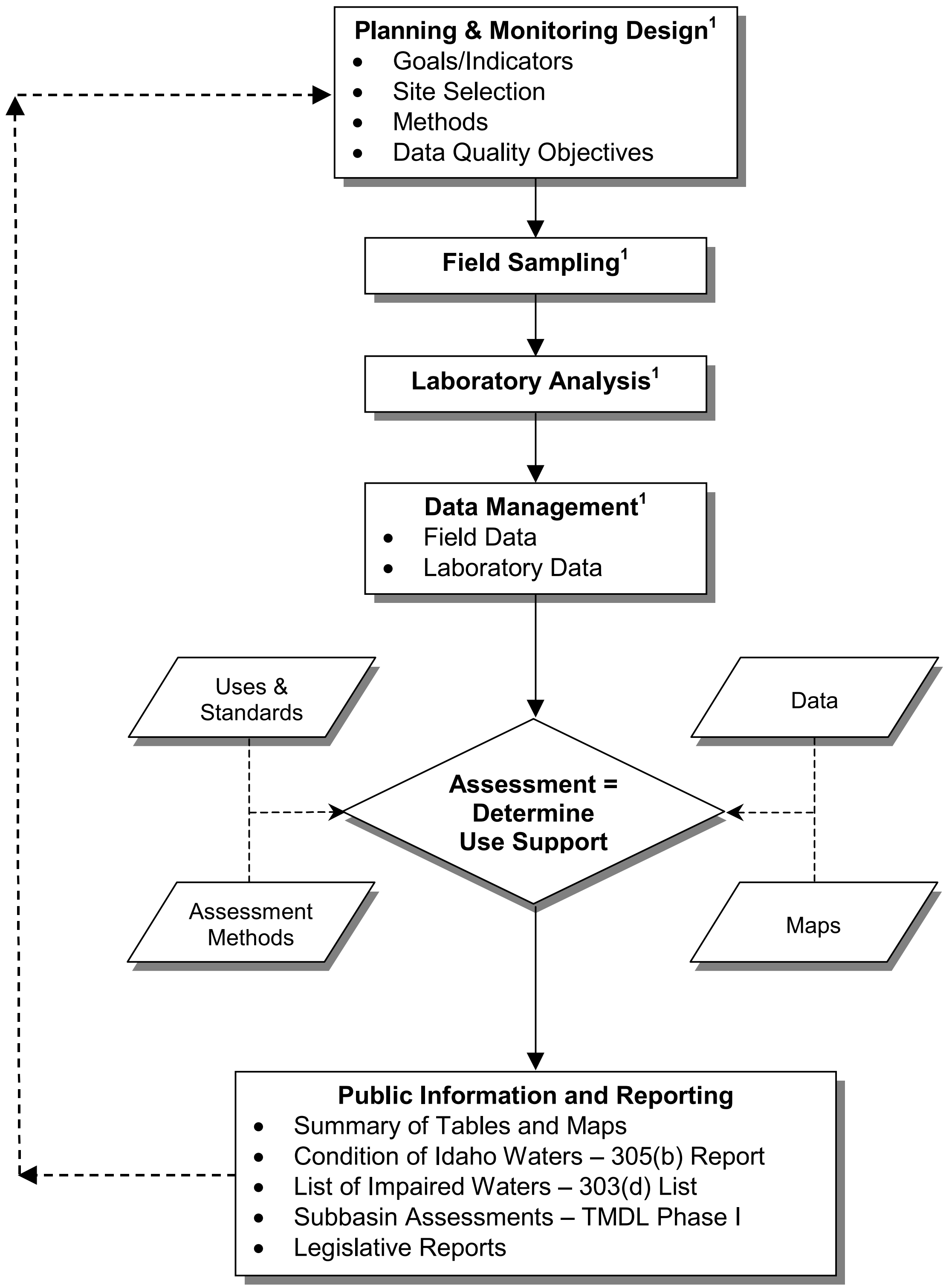
This Water Body Assessment Guidance (WBAG) describes Idaho Department of Environmental Quality (DEQ) methods used to consistently evaluate data and determine beneficial use support of Idaho water bodies. The methodology addresses many reporting requirements of state and federal rules, regulations, and policies. This document is a revision of the first assessment guidance (DEQ 1996) and is intended solely as an analytical tool to guide the assessor through a standardized assessment of beneficial use status.

1.2. Overview of the Assessment Process

An assessment entails analyzing and integrating multiple types of water body data such as biological, physical/chemical, and landscape to address the following objectives.

- Determine the degree of beneficial use support of the water body (i.e., fully supporting versus not fully supporting).
- Determine the degree of biological integrity using biological information or other measures.
- Compile descriptive information about the water body and data used in the assessment.

Figure 1-1 illustrates the assessment process. The process encompasses several steps before DEQ determines use support. DEQ starts by planning and designing the monitoring program. Next, relevant data are collected, analyzed, and aggregated to allow sound and consistent assessments. These assessments determine use support and are then summarized to meet state and federal reporting requirements.



[1] Information regarding the BURP monitoring protocols, laboratory analysis, and data management may be found in annual work plans and quality assurance procedures.

Figure 1-1. Assessment Process Overview

The WBAG is a dynamic document. It will be adapted to meet new needs as assessment methods develop and changes occur to Idaho's Water Quality Standards and Wastewater Treatment Requirements (IDAPA 58.01.02.100)[1].

1.3. How to Use This Document

This document provides the assessor with guidance throughout the water body assessment process. Such guidance includes information on DEQ policies, assumptions, and analytical methods. However, the document does not present a rigid structure limiting flexibility for unique situations or preclude the use of sound scientific judgment. In these situations, it is the DEQ assessor's responsibility to provide justification for variations from the guidance. DEQ may use third-party data sources in the assessment process; however, these sources must undergo data review to determine how the data will be used. Section 3 takes the assessor through this process

The WBAG is limited to perennial, wadeable, and nonwadeable lotic water bodies and applies to both reconnaissance and more intensive monitoring. Although the fundamental approach should also be applicable to lakes, reservoirs, springs, and wetlands, DEQ must further investigate these types of water bodies to develop scientifically sound assessment processes.

This document is organized according to the steps taken in the assessment process. Figure 1-2 illustrates the sequence of these steps. Section 1 addresses the overall process and regulatory setting for the assessment. Section 2 discusses the DEQ monitoring design and data representation methods for collected data. Next, Section 3 explains methods for identifying beneficial uses for assessment purposes. Section 4 describes DEQ criteria for evaluating different types of data and the policies regarding their use. Section 5 concerns policies to interpret numeric criteria exceedances for different physicochemical parameters. The discussion of assessment methods of beneficial uses begins in Section 6 where aquatic life assessment methods and policies are described. Contact recreation (Section 7) follows the aquatic life section, and water supply (Section 8) and wildlife and aesthetics (Section 9) assessment policies complete the methodology sections. Section 10 illustrates assessment procedures through an example, and Section 11 addresses the public appeals process.

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[1] Henceforth, subsections of Idaho Administrative Code within IDAPA 58.01.02 are abbreviated as "WQS.XXX" where XXX is the subsection. For example, "IDAPA 58.01.02.100" is abbreviated as "WQS § 100." Idaho statutes are referred to as "Idaho Code" and abbreviated "IC § 39-3601," for example.

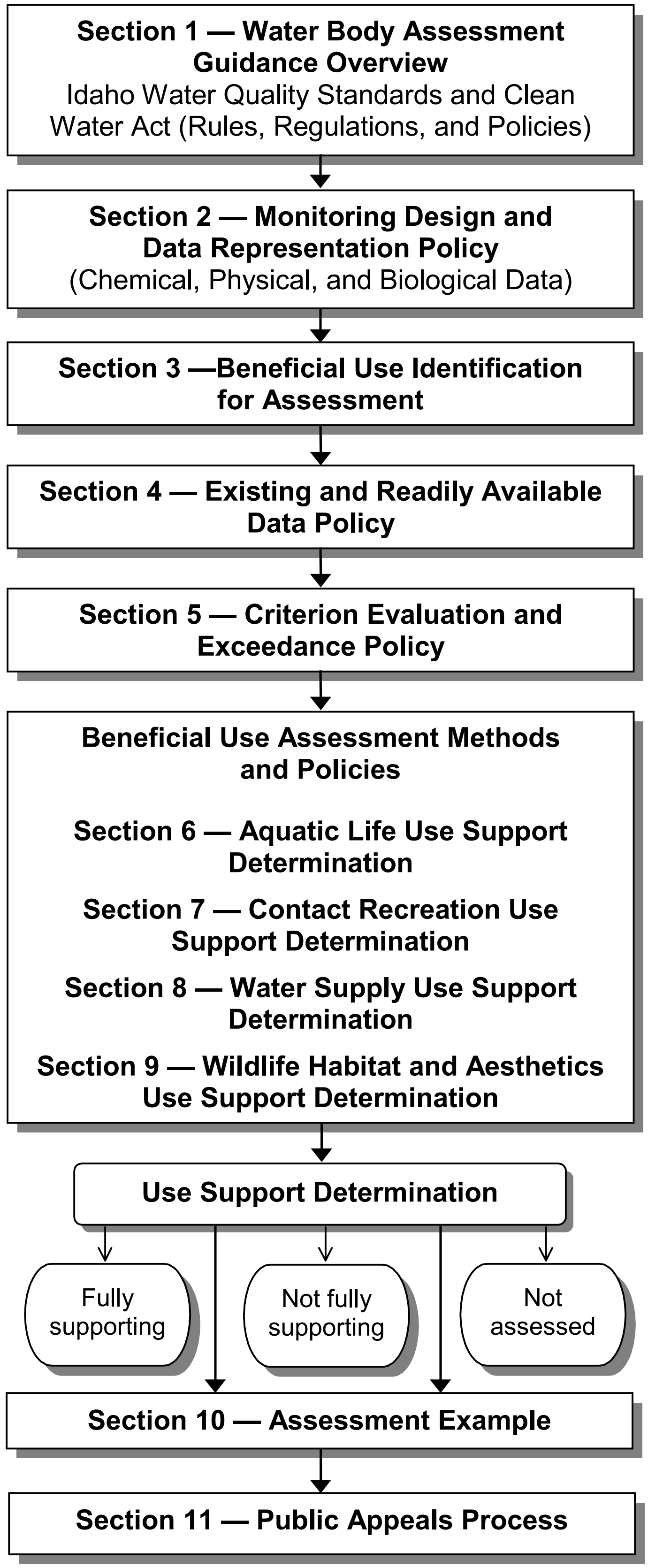


Figure 1-2. Water Body Assessment Guidance Structure

1.4. Regulatory Background

1.4.1. Clean Water Act

In 1972, Congress passed Public Law 92-500, Federal Water Pollution Control Act, commonly known as the Clean Water Act (CWA). The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Water Pollution Control Federation 1987). The act and the programs it generated have changed over the years as experience and perceptions of water quality have changed. It has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to ensure "swimmable and fishable" conditions. This goal, along with the 1972 goal to restore and maintain chemical, physical, and biological integrity, relates water quality with more than just chemistry.

The federal government, through the U.S. Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the country. DEQ implements the CWA in Idaho while the EPA provides oversight of Idaho's fulfillment of CWA requirements and responsibilities.

For the most part, the WBAG addresses federal requirements found in Sections 303 and 305 of the CWA. The statutory and regulatory requirements differ significantly for 303 and 305 documents (EPA 1977). Figure 1-3 illustrates the conceptual relationship among different elements of the water quality program. These sections focus on the following elements.

- Section 303 requires DEQ to adopt, with EPA approval, water quality standards and review those standards every three years. Additionally, DEQ must monitor waters to identify those not meeting water quality standards. For those waters not meeting standards, DEQ must establish total maximum daily loads (TMDLs) for each pollutant impairing the waters. Further, the agency must set appropriate controls to improve water quality and permit the water bodies to meet their designated uses. These requirements result in two reports:

  1) *List of Impaired Waters [303(d) List]*
  This list describes water bodies that do not meet water quality standards. Waters identified on this list require further analysis performed under a TMDL.

  2) *Subbasin Assessment and TMDL*
  The subbasin assessment includes an evaluation and summary of current water quality status, pollutant sources, and control actions to date. DEQ may use the WBAG as one of many tools to interpret data used in a subbasin assessment.

The TMDL is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR Part 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also includes individual pollutant allocations among various sources discharging the pollutant. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

- Section 305 requires a report describing and analyzing the water quality condition of Idaho water bodies. “Condition” is defined as the extent state waters are meeting water quality standards. This document is often referred to as the 305(b) Report. The 305(b) Report includes assessment results from the 303(d) list and subbasin assessments.

1.4.2. Idaho Water Quality Standards

The Idaho water quality standards program, as envisioned in Section 303 of the CWA, is a joint effort between Idaho and EPA. Idaho has primary responsibility for setting, reviewing, revising, and enforcing water quality standards. EPA develops regulations, policies, and guidance to help Idaho implement the program and ensure that our adopted standards are consistent with the requirements of the CWA and relevant regulations. EPA has authority to review and approve or disapprove state standards and, where necessary, to promulgate federal water quality standards (Barbour et al.1999).

Idaho adopts water quality standards (IDAPA 58.01.02 or see http://www2.state.id.us/deq/rules/waterrul.htm) to protect public health or welfare, enhance the quality of water, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

1.4.2.1. Designated Uses

The state may assign or designate beneficial uses for particular Idaho water bodies to support. These beneficial uses are identified in the Idaho water quality standards (WQS § 3.35 and § 100.01 - .05). These uses include:

- aquatic life support — cold water aquatic life, seasonal cold water aquatic life, warm water biota, and salmonid spawning;
- contact recreation — primary (swimming) and secondary (boating);
- water supply — domestic, agricultural, and industrial; and
- wildlife habitat and aesthetics.

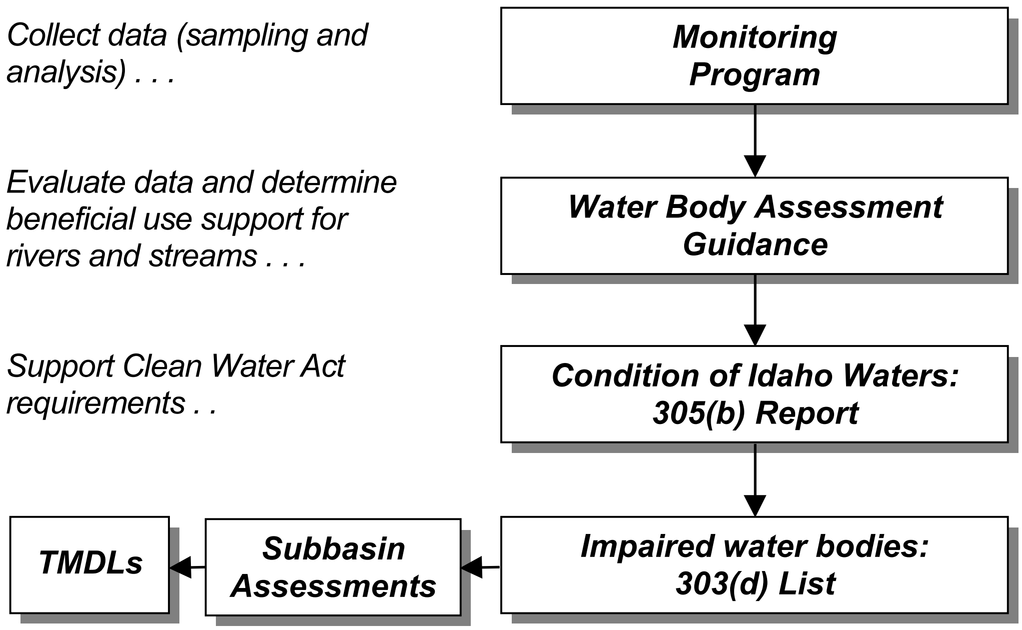


Figure 1-3. Conceptual Relationship Between the 305(b) Report, 303(d) List, Subbasin Assessments, and TMDLs

1.4.2.2. Criteria

Criteria are the conditions presumed to support or protect the designated uses (Karr 1991). These conditions may be expressed as numeric values or narrative statements.

1.4.2.2.1. Numeric Criteria

Numeric criteria generally consist of three components: magnitude, duration, and frequency of a pollutant.

- Magnitude — how much of a pollutant, expressed as a concentration, is allowable.
- Duration — the period of time (averaging period) over which the in-stream concentration is averaged for comparison with criteria concentrations. This specification limits the duration of concentrations above the criteria.
- Frequency — the number of times an event occurs over a fixed time interval.

A typical numeric statement for aquatic life criteria usually contains a concentration and averaging period (WQS § 250 – 253). For example, the water temperature numeric criteria for protection of salmonid spawning (does not address bull trout criteria) is 13 degrees C or less with a maximum daily average no greater than 9 degrees C (WQS § 250.02.e.ii).

1.4.2.2.2. Narrative Criteria

Narrative criteria (WQS § 200) are statements that protect against impairment of beneficial uses by pollutants that have no numeric criteria. The following is an example of a narrative criterion:

"Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses (WQS § 200.06)."

1.4.2.3. Antidegradation

Antidegradation (WQS § 51) describes policies set by the state to maintain water quality even if it exceeds levels necessary to support beneficial uses. Related policies also address waters identified as Outstanding Resource Waters (ORWs) and Special Resource Waters (SRWs). Designation or nomination procedures for such waters are addressed in WQS § 55-56.

Section 2. Monitoring Design and Data Representation Policy

2.1. Monitoring Design

DEQ annually monitors water bodies statewide based on assessment and data quality priorities. Although DEQ may use data collected from other sources, the WBAG is primarily designed to assess data collected under the DEQ Beneficial Use Reconnaissance Program (BURP) and USGS/DEQ Trend Monitoring Network.

2.1.1. Beneficial Use Reconnaissance Program (BURP)

BURP uses a targeted monitoring design to collect physicochemical, physical habitat, and biological data on water bodies. Targeted site selection is used to answer specific questions regarding the condition of particular areas. DEQ specifically selects representative sites with the intent of assessing a broader geographic area.

In 1993, DEQ implemented a rapid bioassessment program (RBP) aimed at integrating biological and chemical monitoring with physical habitat assessment as a way of characterizing water quality and stream integrity (McIntyre 1993). This program, known as BURP, closely follows concepts and methods described in the *Rapid Bioassessment Protocols for Use in Streams and Rivers* developed by EPA (Barbour et al. 1999). The main purpose of BURP is to provide consistency in monitoring, collecting data, and reporting. To the extent possible, the program documents existing beneficial uses of water bodies and provides data for beneficial use support assessments.

DEQ publishes an annual work plan for statewide use by DEQ field crews as well as other entities. There are six regional BURP coordinators who train and direct crews, while the state office BURP coordinator and other staff audit crews to ensure consistent monitoring practices. The monitoring is conducted during the index period of July through September for streams and August through mid-October for rivers. Collected data are transmitted to the state office for quality assurance review and entry into a statewide BURP database. The quality assurance process follows the DEQ *Beneficial Use Reconnaissance Program Quality Assurance Plan for Field Data Sheets on Wadeable (Small) Streams* (DEQ 2001). Biological samples are identified by qualified professional taxonomists and historically, have been sent to the Orma J. Smith Museum at Albertson College of Idaho for curation and storage.

Using this monitoring design, DEQ has extensively monitored Idaho water bodies (see Section 2.2.1. for water body scale). A large percentage of the water bodies that have not been monitored are inaccessible (e.g., wilderness areas or canyons), larger water bodies, reservoirs, or lakes. In 1997, DEQ developed a monitoring protocol for larger water bodies (Grafe 1997) and is working on monitoring protocols for lakes and reservoirs. Further, DEQ is participating in a five-year study that started in 2000 to evaluate randomized sampling methods (e.g., Environmental Monitoring and Assessment Program — EMAP) in the western United States. DEQ will continue to evaluate the strengths and weaknesses of incorporating such a monitoring design into BURP.

2.1.2. USGS/DEQ Trend Monitoring Network

In 1990 the U.S. Geological Survey (USGS), in cooperation with DEQ, implemented a statewide water quality monitoring program. The objective was to provide water-quality managers with a coordinated statewide program to detect trends in surface water quality. The USGS monitors 56 stations (see Figure 2-1) of which 40 are designated as biological sampling sites. To accommodate budget limitations, biological sites are divided among three regions (i.e., southeastern, southwestern, and northern) and sampled once over a three-year rotation (O'Dell et al 1998).

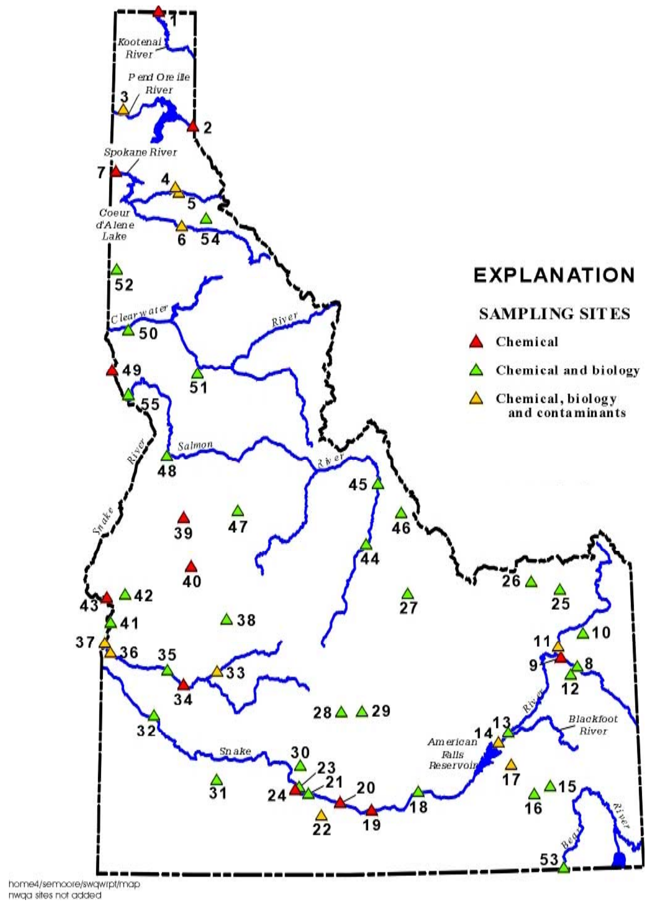


Figure 2-1. USGS/DEQ Trend Monitoring Sites

Water chemistry sample collection occurs monthly during April through September and consists of discharge, specific conductance, pH, temperature, turbidity, dissolved oxygen, bacteria, nutrients, and suspended sediment. Temperature is recorded continuously during summer months (June to September) at sites where samples are collected for biological analyses. Major ions and alkalinity are sampled during base flow conditions in September. Biological sampling occurs during summer/fall low flow conditions and consists of macroinvertebrates, fish, and associated stream habitat parameters (O'Dell et al. 1998). Biological data are collected following protocols designed for the National Water Quality Assessment (NAWQA) Program (Crawford and Luoma, 1993; Cuffney et al. 1993a, 1993b).

2.1.3. Data Management

All data collected under BURP are stored in a centralized database at the state office. Data for each sample site are recorded on standard field sheets. Regional offices house original field forms and send copies directly to the state office for quality assessment (QA) review prior to data entry. During the QA process, the field forms are checked for completeness, legibility, and accuracy. Presently, DEQ does not manage data collected outside the Department. Figure 2-2 illustrates the monitoring and data management processes.

2.2. Data Representation

The extent or size of a water body represented by a given sample site is important because it affects the quality of assessment results. The basis for extrapolating data ultimately depends on the monitoring design and water body scale. DEQ uses a geo-referenced system, known as the Water Body Identification System (WBID), as the foundation for extrapolating data results.

2.2.1. Water Body Identification System (WBID)

The Idaho WBID is a geo-referenced network of Idaho water bodies based on a combination of two hydrography scales: 1:100,000 and 1:250,000. Water bodies are coded according to a 1:250,000 hydrography and named based on a 1:100,000 hydrography. Some water bodies were combined or split based on land use considerations. Canals (unless they follow a natural channel), stock ponds, and tailing ponds are not coded in the system.

The numbering or coding system of the WBID is based on the USGS cataloging units in Idaho. USGS developed hydrologic unit codes (HUCs) as a national standard for water resources planning and data management. In the WBID, each cataloging unit (4^{th} field HUC or 8-digit code) is numbered starting at the pour point. Figure 2-3 provides an example of the WBID system for HUCs.

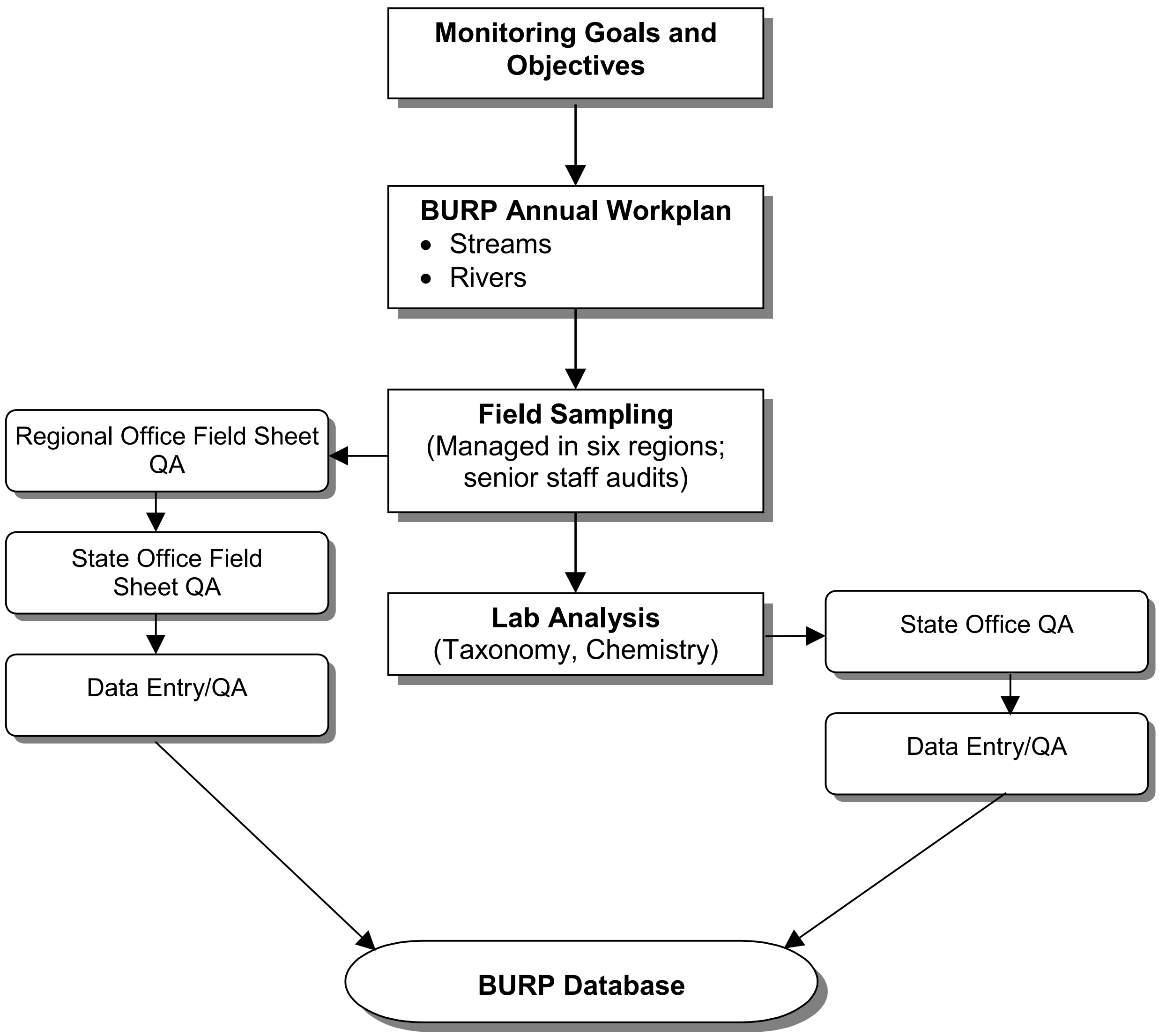


Figure 2-2. Monitoring and Data Management Overview

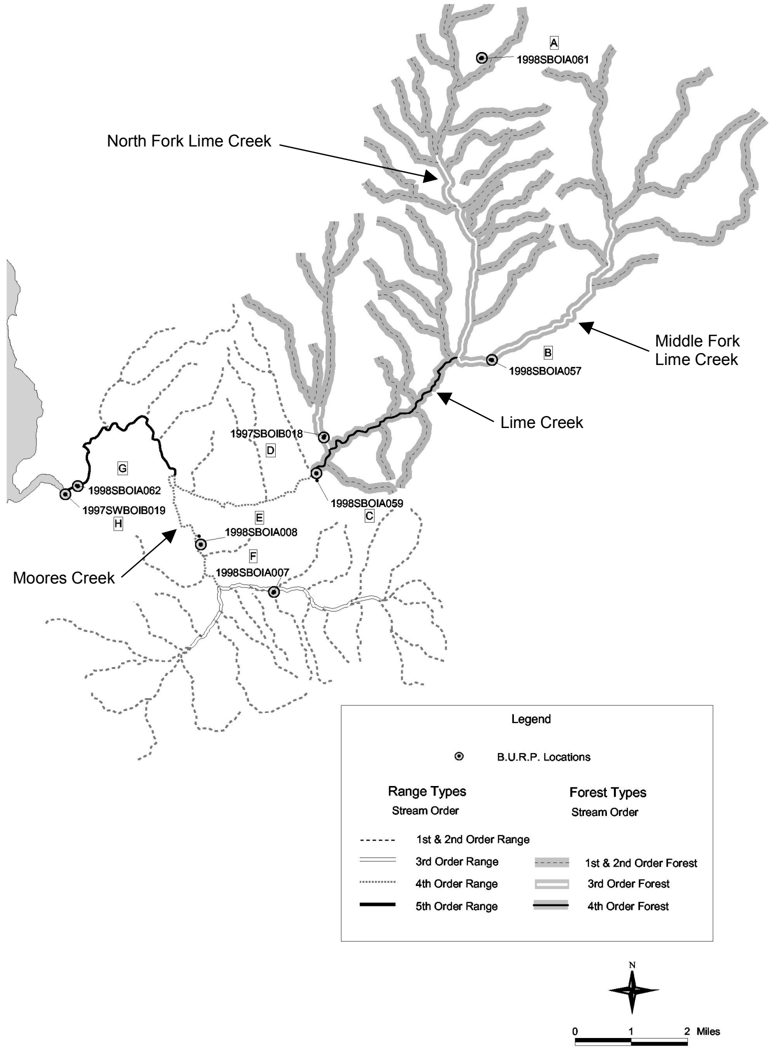


Figure 2-3. Lime Creek 17050113-10 Data Representation Example

The WBID is the basis of identifying water bodies in the water quality standards and implementing the watershed management approach in Idaho. The system is also the basic unit of record for water quality assessment information. The WBID eliminates conflicts and discrepancies between current Idaho water quality standards, and the EPA River Reach, Pacific Northwest River Study, and Bonneville Power numbering systems. Approximately 2,500 water bodies comprise the WBID, which is within the EPA-recommended range for manageable assessments (EPA 1997).

A geo-referenced water body system, such as WBID, is important in integrating location information using Geographic Information System (GIS) technology. GIS technology allows individuals to analyze water bodies and stream reach data spatially. Such spatial analysis improves the reliability of DEQ analysis and assessment methods.

2.2.2. Water Body Stratification

The data representation policy guides the assessor in interpreting and extrapolating data for assessment purposes. The policy is based on a stratification approach using the WBID system. Stratification is a classification method used to characterize comparable segments within each water body identified in the WBID system. In essence, stratification allows DEQ to compare apples to apples and extrapolate site data. The stratification approach must be refined enough to identify suitable groupings of water bodies for assessment purposes, but not so detailed the number of water bodies to be assessed becomes unmanageable.

DEQ reviewed several types of stratifiers and found land use and stream order provide enough assessment resolution without making the process unwieldy. The scale of stratification is based on the WBID. The procedure is to stratify each WBID water body using land use and stream order criteria. DEQ uses the Strahler (Strahler 1957) method at the 1:100,000 scale to determine stream order. DEQ combines first and second order streams with similar land uses. For land use, DEQ uses GIS capabilities and local knowledge to determine locations of land use and sources relative to stream segments. Presently, the most detailed and available information is the National Land Cover Data, which includes information regarding developed land, forested areas, and different agricultural uses. DEQ combines the first and second stream orders to improve the manageability of the stratification procedure since there are over 100,000 miles of streams in Idaho.

In some cases, there may be more than one monitoring site located within a stratified water body, that will be used to evaluate use support. To interpret the aquatic life use support of three or more sites, DEQ averages the results of the multimetric index scores. In cases where there are only two sites, DEQ uses the lower index score to interpret aquatic life use support (see Section 6.5). In evaluating the support status of the other beneficial uses, such as contact recreation, DEQ uses the lowest support status determination. DEQ still applies other data quality policies such as preferring to use data that is five years old or newer.

2.2.3. Water Body Size Determination

The WBAG uses water body size criteria to distinguish between two classes of flowing water: streams and rivers. This distinction is important since DEQ uses different bioassessment tools to assess the aquatic life support use of these two classes (see Section 6). Through literature review and data analysis, DEQ found that no one criterion entirely characterized water body size in Idaho. Consequently, DEQ defines water body size according to three criteria: stream order; average wetted width at base flow; and average depth at base flow. "Chapter 2: Water Body Size Determination" (Grafe 2002a) discusses this determination and supporting analysis in more detail.

Stream order, average wetted width at base flow, and average depth at base flow are rated according to size distinctions originally developed by Idaho State

University (ISU) (Royer and Minshall 1999). For bioassessment purposes, DEQ has condensed the ISU size distinctions into two categories: small and large. The criteria and corresponding size categories are located in Table 2-1.

Table 2-1. Water Body Size Categories Used to Rate Each Criterion

Water Body Size Category	Stream Order	Ave. Width at Base Flow (m)	Ave. Depth at Base Flow (m)	Rating
Large	≥5	≥15	≥0.4	3
Small	<5	<15	<0.4	1

DEQ rates each criterion and then averages the rating or score. Through additional analysis, DEQ found that only two size categories, streams and rivers, were necessary to represent small to large water body characteristics for bioassessment purposes. Consequently, DEQ designates water bodies with average scores of greater than or equal to 1.7 as “rivers” while those water bodies scoring less than 1.7 would be classified as “streams” (see Table 2-2).

DEQ chose 1.7 based on the different combinations of rating results. Specifically, if a water body rated twice (1+1) in the small water body size category and only once (3) in the large category, then the total of five would result in an average score rating of 1.67, just below 1.7. Water bodies that have inconsistent scores in the three categories should be further evaluated using additional measures of stream size. The ultimate goal of determining water body size should be to ensure that the proper aquatic life use assessment process (see Section 6) is used. If the water has physical and biological characteristics indicative of a river rather than a stream the assessor needs to use the river assessment process. Section 10 provides a examples of determining water body size.

Table 2-2. Water Body Size Average Score Rating Categories.

Water Body Class	Average Score Rating
River	≥1.7
Stream	<1.7

Section 3. Beneficial Use Identification for Assessment

Idaho water quality standards state that in determining whether a water body fully supports designated and existing beneficial uses, DEQ shall determine whether all of the applicable water quality standards are being achieved and whether a healthy, balanced biological community is present (WQS § 053). Therefore, in order to determine whether beneficial uses are supported, the assessor needs to first determine which uses are designated or existing. These are determined separately as follows.

3.1. Designated Uses

Surface water use designations are defined and listed in the Idaho water quality standards (WQS § 100-160). These include uses that are applied on a water body-specific basis (aquatic life, recreation, domestic water supply), and uses that are applied to all waters of the state (agricultural and industrial water supply, wildlife habitat, and aesthetics). Waters may also be designated as outstanding or special resource waters (WQS § 055, 056); however, these two designations are not covered in this guidance.

Water bodies with specific use designations are listed in tables in WQS § 110-160 following the Idaho WBID (see Section 2 for an explanation of the WBID system). Unless broken out separately in the tables, use designations listed in the tables as the standards for a WBID unit apply to all perennial segments of waters included within that particular WBID unit. Usually these are tributaries, but in a few cases include nearby disconnected waters, since the WBID system has to encompass all waters in the state. For example, Cottonwood Creek, WBID 17040212-14, is designated for cold water and secondary contact recreation uses. This designation also includes subordinate streams within that WBID unit as shown in Table 3-1.

Table 3-1. Subordinate Streams within WBID 17040212-14

WBID #	WBID Name	Included Waters	Perennial portions also become designated as:
14	Cottonwood Creek	Burnt Creek	COLD SCR[1]
		Cottonwood Creek	COLD SCR
		Dry Cottonwood Creek	COLD SCR
		North Cottonwood Creek	COLD SCR
		Williams Reservoir	COLD SCR

[1] COLD = cold water;
SCR = secondary contact recreation

If, for example, North Cottonwood Creek also had unnamed tributaries, then the cold water and secondary contact recreation designations would apply to those perennial portions of the unnamed tributaries as well.

The distinction that, unless otherwise designated, the use designations of a WBID unit only apply to perennial portions of waters in the WBID is necessary because of the inclusive manner in which WBIDs are defined. Somewhere in the continuum of stream channels from rivers to rills, there is a point above which a rivulet is so small that it cannot provide an aquatic habitat that can support a biological community with composition and function similar to reference conditions. All of the aquatic life uses presume fully established biological communities, which in turn presume a persistent aquatic environment. Temporary waters (e.g., intermittent streams, vernal pools) may have important ecological functions but cannot attain the same biological communities as perennial waters.

3.2. Undesignated Surface Waters

Waters listed in WQS § 110-160 for which uses have not yet been designated or which have incomplete use designations are considered undesignated waters for those uses. Two concepts that are important for determining which beneficial uses are to be protected, and thus assessed on undesignated waters, are addressed in the Idaho WQS: presumed uses and existing uses.

3.2.1. Presumed Uses

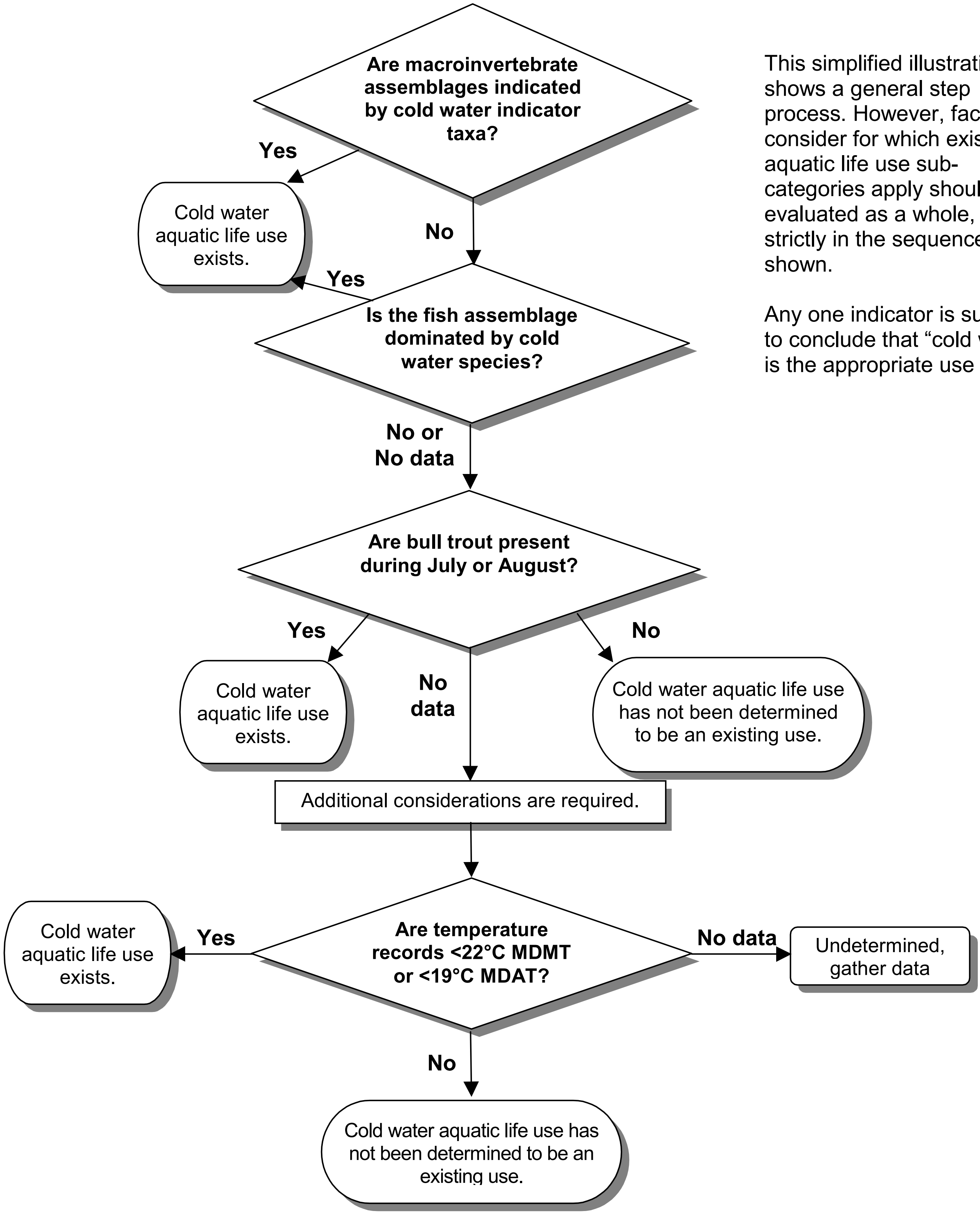
DEQ presumes that most waters in Idaho will support cold water aquatic life and, depending on the characteristics of the water body (Section 7), primary or secondary contact recreation (WQS § 101.01a). Cold water aquatic life use support determination procedures, including numeric criteria and recreation criteria, apply to undesignated, perennial waters to protect these presumptive uses. If an undesignated surface water body is intermittent (i.e., has zero flow at some time during most years), then aquatic community indexes cannot be applied; however, numeric criteria do apply to intermittent waters during periods of “optimal” flow (see WQS § 003.51, 070.07).

3.2.2. Existing Uses

Existing beneficial uses of the waters of the state are to be protected, even if not designated (WQS § 050.02b). “Existing” is defined as more recent than 1975, if the use no longer can be documented to occur. Section 7 describes how to determine which recreational use is “existing.” For the purpose of determining whether a water body fully supports designated and existing beneficial uses per the WQS § 053, aquatic life beneficial uses may be assumed to exist as described in Section 3.2.2.1. These initial determinations of existing aquatic life uses are needed to complete water body assessments and to assemble a 303(d) list. Actual subsequent use designations may be different, depending upon additional information that may be received following the procedures described in Idaho Code 39-3604 and the WQS § 101.01.

3.2.2.1. Cold Water, Seasonal Cold Water, or Warm Water Aquatic Life Use (ALUS) Determination

In an effort to reflect that the temperature patterns of natural waters are expected to occur across a gradient of very cold to warmer waters as they progress from the mountains toward the oceans, the aquatic life use designations include three sub-categories of aquatic life uses according to temperature. However, the WBAG is focused on evaluating cold water aquatic life uses, so existing use determinations of seasonal cold or warm water aquatic life uses are not included here. The following sections describe several lines of evidence to determine whether the cold water aquatic life use should be assessed. These involve evaluating either literature-derived or empirically-derived macroinvertebrate cold water indicator taxa lists, fish cold water indicator taxa, the fishery classification, and temperature data logger records. If these lines of evidence are *inconclusive*, the assessor may presume a cold water aquatic life use and proceed with the assessment. If the lines of evidence *conflict* with the presumption of cold water aquatic life use, use support should not be assessed using cold water aquatic life indexes (see Figure 3-1).



This simplified illustration shows a general step process. However, factors to consider for which existing aquatic life use sub-categories apply should be evaluated as a whole, not strictly in the sequence shown.

Any one indicator is sufficient to conclude that "cold water" is the appropriate use class.

Figure 3-1. Cold Water Existing Use Determination for Undesignated Waters

The cold water indicators set forth in Figure 3-1 and described below are not exclusive of one another, nor is there a basis for applying them in a strict hierarchical manner. If these aquatic life use indicators provide conflicting information for an undesignated water body, generally it would be prudent to not determine an existing use nor designate the water body until more information can be obtained to resolve the question. However, if data are abundant, but ambiguous to which aquatic life use is "existing," obtaining more, similar data is unlikely to be helpful. In this situation, a decision concerning what is an existing use simply needs to be made and documented. Such decisions should err toward cooler use classifications.

Macroinvertebrate cold water indicator taxa

Benthic macroinvertebrates are the preferred indicator fauna because of their typical life history patterns. Many benthic macroinvertebrates have either limited migration patterns or a sessile form of life. This makes them well suited for evaluating site-specific environmental conditions. Some macroinvertebrate species are only present in streams with cold temperatures. If these species are present, then one can conclude that the stream likely has consistently cold temperatures. Lists of macroinvertebrate cold water indicator species have been developed from two sources: 1) empirical relationships between species occurrence and temperatures that were found in an analysis of the Idaho Beneficial Use Reconnaissance Program data (Appendix A) and 2) review of published literature reports (Appendix B).

An empirically-derived list of cold water indicator taxa was derived by analyzing temperature and species co-occurrence (Brandt, Appendix A). In an attempt to determine the obligate cold water taxa found in Idaho streams, the temperature data and macroinvertebrate communities of more than 1000 sampling locations were analyzed. From this information the probability of an individual taxa being present in any given temperature was determined. Specifically, 137 of 289 commonly occurring taxa exhibited a distinct temperature preference. Cold water obligates were determined by selecting the taxa that had less than a 10 percent probability of occurring in streams where the water temperature exceeded 19°C. 19°C is the maximum average daily temperature considered suitable for cold water aquatic life (WQS § 250.02). This resulted in a list of 64 cold water obligate taxa that commonly occur in Idaho stream samples (Brandt 2001 and see Appendix A). At sites at which stream temperatures were less than 19°C at the time macroinvertebrate samples were taken, greater than or equal to two taxa from the empirically-derived cold water taxa list were usually collected. Thus for assessment purposes, DEQ will also assume that cold water aquatic life is an existing beneficial use for undesignated streams when greater than or equal to two taxa from the empirically-derived list of cold water macroinvertebrate indicator taxa are present.

A list of cold water indicator taxa was derived from published accounts of thermal requirements for some Idaho benthic macroinvertebrates by Lester and Robinson (2000). This list is summarized in Appendix B.

Similarly to the evaluation of occurrences of the empirically-derived cold water taxa list and stream temperatures, the literature-derived list of cold water invertebrate was compared with stream temperatures to provide a basis for assuming a cold water existing use and the use of aquatic life use indexes for undesignated streams. The statewide surface water monitoring program was selected for this evaluation because its 56 stations were selected to be representative of the major drainages of Idaho. The statewide surface water quality monitoring network is a comprehensive program that has collected both continuous temperature records and macroinvertebrates from the same locations (O'Dell et al. 1998). Monitoring results (Maret et al. 2001) were reviewed to estimate the number and percentages of literature-derived list of cold water indicator taxa likely at sites where summer stream temperatures met cold water aquatic life criteria. At sites where summer temperatures never exceeded the maximum cold water aquatic life temperature criterion, 0 to 6 cold water indicator taxa were collected with an average of 1.4 taxa, and 0 to 9 percent of macroinvertebrates were listed as cold water taxa with an average of 1.0 percent. From this comparison, DEQ thinks if, using the literature derived cold water taxa list, it likely that if greater than or equal to 3 cold water taxa are present in a sample, or if greater than or equal to 3 percent of the entire sample consisted of cold water indicator taxa, stream temperatures at the site would usually be less than cold water criteria, and cold water aquatic life could be assumed as an existing use.

Thus for assessment purposes, DEQ will assume that cold water aquatic life is an existing beneficial use for undesignated streams when using the *empirically-derived* cold water taxa list (Appendix A), greater than or equal to 2 macroinvertebrate cold water indicator taxa are present, or when using the *literature-derived* cold water taxa list (Appendix B), greater than or equal to 3 macroinvertebrate cold water indicator taxa are present, or when greater than or equal to 3 percent of the assemblage consists of cold water indicator taxa. An simplified example follows (Table 3-2).

Table 3-2. Example of cold water existing use indications using macroinvertebrate taxa lists

Taxa	Order (common name)	Classification	Count
Baetis bicaudatus	Mayfly	Cold (E,L)	26
Baetis tricaudatus	Mayfly		12
Rhyacophila verrula	Caddisfly	Cold (E,L)	26
Tricorythodes minutus	Mayfly		12
Epeorus longimanus	Mayfly		24
Totals 5 taxa			100 individuals
Table Notes Classification: E – Empirically derived cold water taxa list (Appendix A); L – Literature derived cold water taxa list (Appendix B)			

In this example, both the empirically derived and literature derived taxa lists considered 2 taxa to be cold water indicator taxa. This is sufficient to assume a cold water aquatic life existing use. Further, 52/100 individuals, or 52% were cold water macroinvertebrates using the literature derived lists, which would add further support to the assumption of cold water aquatic life as an existing use.

<u>Fish cold water indicator taxa</u>

Fish species observed at a site may indicate if cold water aquatic life use may be considered an existing use for a water body. Fish are less desirable for this purpose than macroinvertebrates because of their motility. However, since there are many fewer species of fish than aquatic macroinvertebrates, and they have been comparatively well studied, the literature on thermal requirements of fish is much more complete than that for invertebrates. Cold water aquatic life should be considered an existing use if the fish assemblage at a site is dominated by cold water adapted species. "Dominated by" means that either greater than or equal to 50 percent of the species present, or greater than or equal to 50 percent or more of individual fish in a sample, are classified as cold water species. A listing of fish species temperature classifications is in Appendix C.

The dominance test is needed because the mere presence of cold water adapted species is usually insufficient to determine a cold water existing use. This is because waters for which both cold and cool water species occur could be considered to have a seasonal cold-water existing use. The use of greater than or equal to 50 percent of cold water individuals for this purpose is supported by analyses in the stream and river fish index technical reports. Among reference sites, the median percentage of cold water individuals in forest streams was 100 percent, and for rangeland streams and for rivers, the median percentage of cold water individuals was greater than 50 percent. Further, one fish species, bull trout, is highly stenothermal, i.e. found only in cold waters. Three independent analyses of large data sets showed that bull trout are unlikely to be found in the wild at temperatures greater than 19°C (Rieman and Chandler 1999, Mebane 2000a, and Dunham and Chandler 2001). Thus for assessment purposes, DEQ will also assume that cold water aquatic life is an existing beneficial use for undesignated streams if the presence of an individual bull trout during July or August is documented.

Temperature data logger records

If representative temperature data logger records are available for a water body, they may be used to evaluate which aquatic life sub-category is the appropriate use. If the maximum daily maximum temperatures (MDMT) do not exceed 22°C, or if the maximum daily average temperatures (MDAT) do not exceed 19°C, then a cold water aquatic life temperature regime is likely present. These temperatures are the current numeric temperature standards for cold water aquatic life. Measured MDATs and MDMTs should be rounded off to the nearest 1°C for this purpose.

Fishery management objectives

A further source of information for determining if cold water aquatic life is the appropriate existing use to assess on undesignated waters is the *Idaho Fisheries Management Plan* (IDFG 2000). This plan provides information on management goals, species present, and desired management direction (e.g., habitat maintenance and protection needs) for many waters of the state. Where available, the *Idaho Fisheries Management Plan* and other reports of the IDFG may be used to document an existing use, or used as supporting information for determinations. IDFG considers native sport fish (native salmonids and sturgeon) to be the primary fish species to be protected through their management. However, where habitat conditions are unsuitable for native sport fish (e.g., due to river to reservoir conversions or other factors), and to provide diverse fishing opportunities, some waters are managed for warm water fisheries. The aquatic life use classifications and fisheries management type classifications should generally correspond, as shown in Table 3-3. These water quality and fisheries management categories may not exactly match for adjacent categories in the table. For example, some waters managed for mixed fisheries may still be designated for cold water aquatic life use, or a seasonal cold use determination may be made for a water body managed for mixed use. However, by their definitions, waters managed for a cold water fishery should not be designated for warm water aquatic life or vice versa. While conflicting use designations should be reviewed in consultation with IDFG, and resolved, revisions to use designations are beyond the scope of water body assessment.

Table 3-3. Comparison of DEQ and IDFG management terms

Aquatic life use classifications	Fisheries Type[1]
Cold water	Cold water or anadromous fishery
Season cold water	Mixed Fishery
Warm water	Warm water fishery

[1]IDFG fisheries type definitions:

- Cold water - fisheries supported by resident populations of salmonid game fish including trout, char, nonanadromous salmon (kokanee, coho, and chinook), and whitefish (family Salmonidae).
- Warm water - fisheries supported by warm water or cool water game fish including bass, crappie, sunfish, catfish, northern pike, tiger muskie, walleye, and yellow perch (families Centrarchidae, Ictaluridae, Percidae, and Esocidae).
- Mixed - fisheries supported by a combination of cold water and warm water fish species.
- Anadromous - fisheries supported by anadromous salmonids (steelhead trout, chinook salmon, and sockeye salmon).

If, for a perennial water body, data are insufficient to determine whether cold water or seasonal cold water uses are existing uses, then a cold water aquatic life use is presumed, and its applicable numeric water quality standards apply. To determine the spatial extent of an existing use by extrapolating data from a sample site to a water body, refer to Section 2.

3.2.2.2. Salmonid Spawning

Waters that provide or could provide a habitat for self-propagating populations of salmonid species are to be protected for salmonid spawning (WQS § 100.01b). Evidence of reproduction is considered evidence that the waters provide or could provide habitat for salmonid spawning. Summertime presence of juvenile salmonids (i.e., individuals less than 100 mm overall length) in first through fourth order streams may be considered sufficient evidence that salmonid spawning has occurred in the near vicinity. In that case, salmonid spawning may be considered an existing use for assessment purposes in the portions of the stream for which the site is representative.

The presence of juvenile salmonids in streams is considered indicative of nearby spawning because most resident or anadromous trout and salmon species migrate to their natal streams to spawn. Further, juvenile salmonids may move downstream from natal streams into larger waters after hatching (Bjornn and Reiser 1991). Thus, the presence of juvenile salmonids in a river may not necessarily indicate that the fish hatched there. Before considering salmonid spawning to be an existing use for a larger stream (greater than fourth order), in addition to the presence of juvenile fish, additional evidence would be needed such as presence of suitable habitat characteristics (e.g., substrate, depth, velocity, and temperature; see Bjornn and Reiser,1991) or actual observations of spawning.

3.2.2.3. Contact Recreation Uses

For primary and secondary contact recreation, DEQ evaluates evidence of recreational uses in the water body. There are three main categories of evidence to identify primary contact as the recreation use:

- designated recreational facilities (swimming areas or bathing beaches);
- water body size (generally, greater water body depth and width would allow a moderate to high probability of primary contact); or
- accessibility (generally, an accessible water body combined with a large size would allow a moderate to high probability of primary contact).

If there are no indications of primary contact use, then the assessor evaluates the water body according to secondary contact recreation criteria. For assessment purposes, the only difference this will make is in the application of the *E. coli* instantaneous standard to determine requirements for additional sampling.

3.2.2.4. Water Supply Uses

Water supply uses requiring assessment include domestic, agricultural, and industrial. Agricultural and industrial beneficial uses are presumed for all Idaho water bodies. Most Idaho drinking water is supplied by ground water; however, there are some public water systems supplied by surface water. To determine if domestic water supply is a beneficial use, the assessor should refer to the Idaho drinking water standards. The standards define a public water system as one that serves 25 or more persons on a regular basis or a system with 15 or more service connections (42 U.S.C.A. § 7401 et seq.). DEQ also presumes a domestic water supply as a beneficial use if the agency receives notification by interested parties that this use exists.

Section 4. Existing and Readily Available Data Policy

Data are the foundation of DEQ's assessment process. Although the WBAG was designed primarily to assess BURP data obtained by DEQ, DEQ also considers existing and readily available data from other sources. The data used in the assessment process may be from other agencies, institutions, commercial interests, interest groups, or individuals and may relate to the existence, support status, or associated criteria for the beneficial uses in a water body. This section explains how DEQ classifies data as Tier I, II, or III and how that data is used in water quality decisions.

Tier II or III data are not used in 303(d) listing determinations but are used in other water quality decisions requiring assessment information. DEQ will use outside Tier I BURP-compatible data in the multimetric index process. If Tier I data are not BURP compatible or are not in an electronic format they will not be run through the multimetric indexes, but may be used to determine numeric criteria exceedances (Section 5) or beneficial use support determinations (Section 6) depending upon their form as explained further in this section. Figure 4-1 represents the process of determining how non-DEQ data can be used in DEQ's water body assessment process.

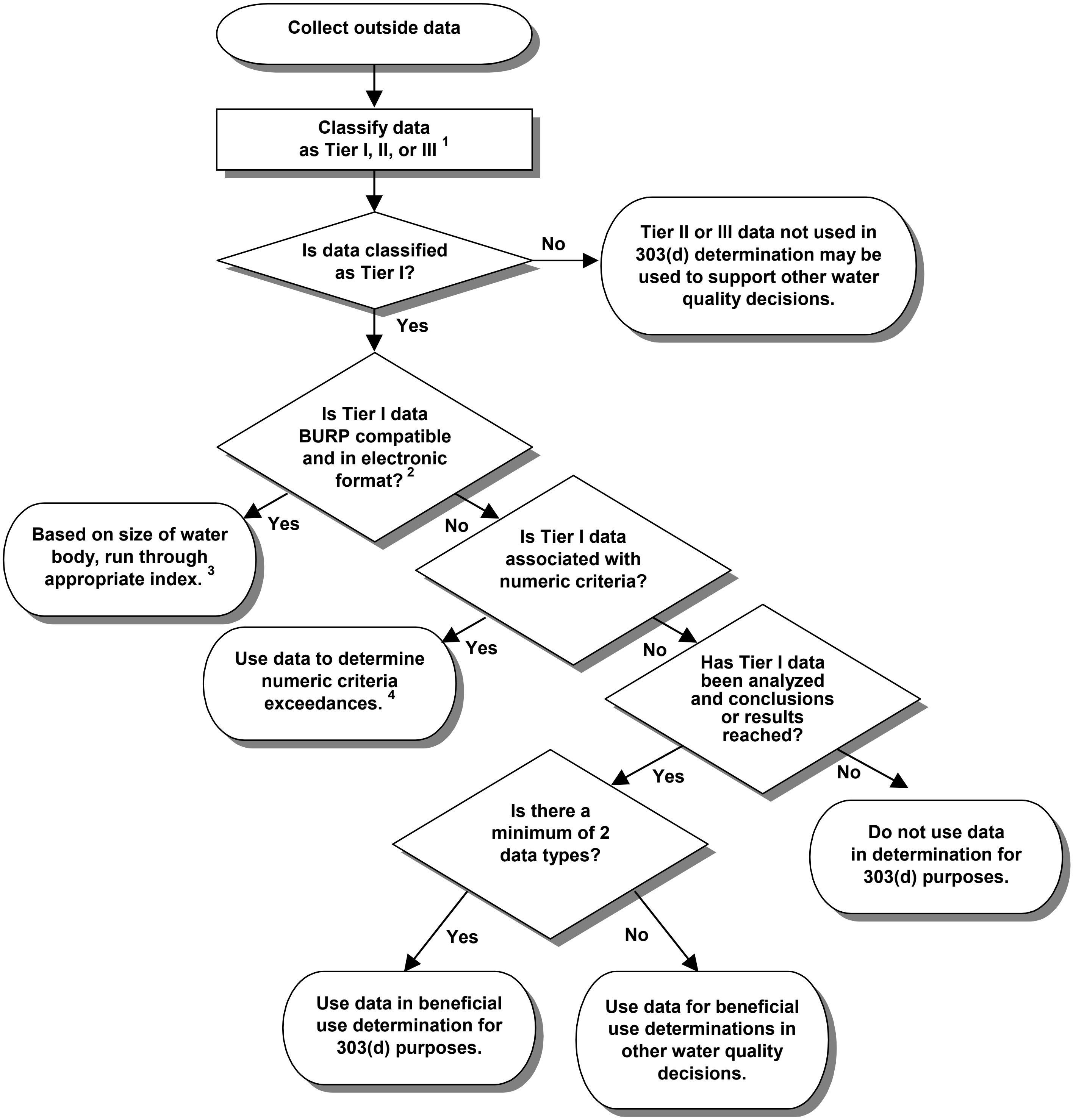
To obtain outside data, DEQ will publicize a request for data and solicit data from appropriate sources for water bodies targeted for assessment. An example of a DEQ data request letter is shown in Figure 4-1.

4.1. BURP-Compatible Data

If DEQ receives BURP-compatible data in an electronic format for a water body, the data will be incorporated directly into the appropriate assessment index and the results used to determine water body status. BURP-compatible data are collected in the same manner as DEQ data. All the multimetric indexes DEQ uses were developed using BURP-compatible data. Consequently, BURP-compatible data are necessary to correctly calculate and apply the various biological and habitat indexes used in assessing aquatic life (see Section 6). In this way, index outputs can be directly compared to one another. Not doing so introduces variability and bias brought on by different sampling equipment, locations, or times that may invalidate the comparison (EPA 1997). This is analogous to comparing apples to oranges. DEQ characterizes compatible data as having similar protocols to those used in BURP (see Table 4-1). DEQ treats BURP-compatible data equally with regards to the data integration methods described in Section 6.

Table 4-1. BURP Compatible Requirements

Parameter or assemblage	Requirements to be considered compatible to BURP
Macroinvertebrates	Quantitative sampler, sampled in riffles, 500 micrometer mesh, collected during July 1 through October 15, insects identified to lowest possible taxonomic level
Fish	Fish assemblage sampled with a battery or gas powered electrofisher, over 100m of stream sampled, effort recorded, fish identified, species counted, and lengths of salmonids and cottids recorded
Algae	Quantitative sampler, collected from natural substrate in riffle, minimum of 800 valves enumerated to lowest possible taxonomic level for diatoms
Habitat	Minimum of 10 habitat parameters sampled some are rated (r) while others are measured (m): instream cover (r), large organic debris (m), % fines <2mm (m), embeddedness (r), number of wolman size categories (m), channel shape (r), bank vegetation (m), canopy cover (m), disruptive pressures (r), zone of influence (r)



[1] See Table 4-2
[2] See Table 4-1
[3] See Section 6 either river or stream
[4] See Section 5

Figure 4-1. How Data Is Used in the Water Body Assessment Process

July 1, 2000

John Smith
U.S. Forest Service
123 State Street
Anywhere, Idaho 12345

Dear Mr. Smith:

The Boise Regional Office of the Idaho Department of Environmental Quality (DEQ) will be assessing the water quality beneficial uses of Deep Creek within your management area. Beneficial uses include aquatic life, salmonid spawning, contact recreation, agricultural water supply, domestic water supply, industrial water supply, wildlife, and aesthetics. DEQ will evaluate the beneficial uses for monitored water bodies using the DEQ Water Body Assessment Guidance. We are requesting data from you to help with this effort.

Specifically, the following types of data and information would be helpful:

- water column chemistry data (e.g., dissolved oxygen, ammonia, phosphorous, metals, etc.);
- physical data (e.g., temperature, riparian proper functioning condition, cumulative watershed effects, etc.);
- biological or bioassessment data (e.g., macroinvertebrate, fisheries, periphyton, etc.); and
- land use data including location, size, and types of specific land uses.

When providing us with collected data, please also furnish information about the quality assurance and quality control procedures used. We will review the data and information. Data less than five years old and in computer readable format is particularly helpful. The furnished data may be used for a variety of purposes including comprehensive state water quality assessments [305(b) reports], water quality impairment lists [303(d) lists], and total maximum daily loads (TMDLs). Thank you in advance for your help with this effort. If you have already supplied us with the requested data, then please disregard this inquiry.

Sincerely,

Jane Doe
Regional Water Quality Assessor

Figure 4-2. Example of Data Request Letter

4.2. How Data Is Evaluated — Tiered Approach

Although the WBAG was designed primarily to assess BURP data, DEQ also evaluates existing and readily available data from other sources. "Evaluate" means to consider submitted data for use in beneficial use determinations including aquatic life use support determinations. Specifically, DEQ evaluates the scientific rigor and relevance of non-BURP compatible data to determine where and how it will be incorporated into the assessment process and other water quality decisions (EPA 1997). Numeric data that relate to specific water quality criteria are evaluated according to the criterion evaluation and exceedance policy described in Section 5.

Other types of data may be used to affirm or change a use support determination based on the scientific rigor and relevance used to collect and analyze the data, as well as its significance to the assessment process. DEQ uses a tiered approach to provide consistent weighting and consideration of various types of data. Initial aquatic life support status calls may be confirmed or modified based on other available information (see Section 6). Table 4-2 summarizes the three tiers and provides examples of different data types in each tier. The table also describes how DEQ uses different tiered-data for planning and reporting purposes.

Table 4-2. Description, Examples, and Incorporation of Data Tiers

Tier	Scientific Rigor	Relevance	Example	How Used
I	• Quantitative. • Parameters measured. • Established monitoring plan with QA and defined protocols. • >30 hours of supervised training. • Samples processed in EPA-certified lab following standard methods or by professional taxonomist. • Organisms identified by a professional taxonomist.	• Data relates to either water quality standard(s), especially numeric, or a beneficial use. • ≤5 years old. • Data relates to a named water body (GIS, latitude and longitude or map location provided).	• Ph.D. or masters thesis. • Published or printed studies or reports. • Published predictive models. • EPA EMAP. • BURP data. • Use attainability analyses. • Rapid Bioassessment Protocols (RBP).	• 303(d) listing or de-listing. • 305(b) reports • subbasin assessments. • TMDLs. • Planning for future monitoring.
II	• Qualitative or semi-quantitative in nature. • May have a monitoring plan. • No QA/QC provided for within plan. • Protocols may or may not be defined. • Parameters rated. • Field staff may not be trained: Lab may not be certified. • Taxonomist may not be a professional.	• Data may relate to a watershed. • Not water body specific. • Data >5 years old. • Data may relate to other agency guidelines or objectives.	• Environmental assessments. • Proper Functioning Condition. • Cumulative Watershed Effects. • Most citizen monitoring. • Models with documentation. • Agency planning documents.	• 305(b) reports. • Subbasin assessments or TMDLs when data adds to overall assessment quality. • Planning for future monitoring.
III	• May be qualitative in nature. • Parameters evaluated. • Field staff have little to no training. • No documented monitoring plan. • No QA/QC. • Anecdotal in nature.	• Not specific to water quality standards or beneficial uses. • Location not specific. • Data ≥10 years old.	• Non-specific reports or studies. • Newspaper articles. • Simple models without any documentation.	• Planning for future monitoring. • Hold for further investigations.

4.2.1. Scientific Rigor

Scientific rigor concerns the extent that scientific methods are used to collect and analyze data. It encompasses quality assurance, quality control, training, level of expertise, and protocols. DEQ categorizes data into three tiers of scientific rigor with more weight given to data with a higher level of scientific rigor.

4.2.2. Data Relevance

Data must be relevant as well as scientifically rigorous to be incorporated into the assessment process. To determine relevance, DEQ applies a two-part test:

1. Data must relate to a water quality standard, beneficial use, or cause of impairment and;

2. Data must be tied geographically to a particular site on a particular water body. Location information such as latitude and longitude (GPS), a specific map, or public land survey system (i.e., township and range) description must accompany the data.

4.2.3. Tier Descriptions

4.2.3.1. Tier I

The scientific rigor of Tier I data is characterized as high and typically includes monitored data collected by professional scientists or professionally trained technicians with more than 30 hours of supervised training. The data are collected and analyzed under a monitoring plan with quality assurance and parameters measured. Samples are processed in an EPA-certified lab following standard methods or by a professional taxonomist. Biological data may come from one of several different assemblages, such as macroinvertebrates, fish, or algae, and are identified by a professional taxonomist. Physical habitat data may have quantitative measurements and standardized qualitative assessment procedures.

To be considered relevant, Tier I data usually include direct measurements or observations of beneficial uses, criteria, or causes of impairment. In addition, the sampling needs to be representative, that is, 1) to have been conducted at multiple times and locations or 2) at a representative location with specific locations identified on a map or with GIS. The information must be less than five years old and must be able to be differentiated along a gradient of environmental conditions (EPA 1998). Predictive models must include calibration factors and, as noted below, are not used exclusively to make beneficial use determinations.

Examples of the types of monitoring data typically meeting Tier I criteria include BURP, EPA Environmental Management and Assessment Program (EMAP), RBP, Use Attainability Analyses, graduate theses, and professionally prepared and peer-reviewed studies, reports, or predictive models. These data can come from a number of possible sources such as state and federal agencies, academic institutions, local governments, or private parties. Tier I data are of sufficient quality and relevance to be used for 303(d) listing and de-listing decisions, 305(b) reports, subbasin assessments, and TMDL development. Data must meet both scientific rigor and relevance of Tier I criteria to be classified at the Tier I level.

4.2.3.2. Tier II

DEQ characterizes the scientific rigor of Tier II data as qualitative or semi-quantitative data. The data collectors will have followed documented field, laboratory, and data-handling protocols, have rated parameters, and may have a monitoring plan. The monitoring plan may not provide quality assurance (QA) or quality control (QC) information. Tier II data include professionally conducted evaluations and habitat data consisting primarily of standardized visual assessments or evaluations. However, some field staff may not be trained, the evaluating laboratory may not be certified, or a professional taxonomist may not identify the samples. Relevant Tier II data may include evaluations based on monitored or evaluated data more than five years old, watershed land use information, modeling results with estimated inputs, or measurement of an atypical event (EPA 1998). Data may relate to a watershed rather than be water body specific. They may also relate to guidelines or objectives of other government entities.

Data collected for Environmental Assessments, Proper Functioning Condition (PFC) assessments, Cumulative Watershed Effects (CWE) Process, and agency planning documents, as well as Citizen Volunteer Monitoring data, are examples of types of data that would be considered Tier II. Tier II data are not used in 303(d) listing decisions due to higher data requirements for impairment decisions under Section 303 (see Section 1.4.1). However, Tier II data may be used in subbasin assessments and TMDLs when the assessor has the time to consider these data in context with other collected information. These data can also be used to establish beneifical uses for assessments and in 305(b) reports (see Table 4-2).

4.2.3.3. Tier III

The scientific rigor of Tier III data often includes information collected by unknown or untrained individuals. The data may not have been collected or analyzed following standard or reported protocols. Data without any originating documentation also appears in this category. Relevance of data is limited due to information having no intrinsic judgment or known reference for comparison. The data may have been extrapolated based on other sites, or a reflection of a specific localized condition not representative of the water body. This type of information may be considered as general background information, but it is not of sufficient rigor and relevance for listing decisions or regulatory actions.

Tier III data are not used in 303(d) decisions, subbasin assessments, TMDLs, or 305(b) reports due to the uncertainty in the scientific rigor in their collection and relevance to beneficial uses or water quality standards. This data may be used in helping DEQ target future planning and monitoring.

4.3. How Tier I Data Are Used In Beneficial Use Determinations

In summary, data are used for different water quality decisions depending on how it is classified. As noted above, only Tier I data are used in making a 303(d) listing or de-listing decision. As shown in Figure 4-1, the format of the Tier I data will determine its use. The sections below describe how DEQ uses different forms of Tier I data.

4.3.1. Tier I and BURP Compatible Data

As explained in Section 4.1, if the Tier I data are BURP compatible (see Table 4-1.) and in electronic form, they are run through the appropriate multimetric index and the results are used to determine the status of the water body. A minimum of two different indexes are required for data integration and the determination of aquatic life use support (see Section 6). The requirement of two or more different indexes does not supersede the minimum threshold policy for macroinvertebrates or fish as discussed in Section 6.

4.3.2. Tier I Data Associated with Numeric Criteria

If Tier I data are associated with numeric criteria, then DEQ will assess this data according to the criteria exceedance policies described in Section 5. A single data type can be used to determine numeric criteria exceedances. Data type is defined as one set of particular data. For instance, one set of temperature results from continuous data loggers (i.e., thermagraphs) is considered one data type. DEQ prefers Tier I data submitted in electronic form and the accompaniment of analysis and conclusions. However, DEQ will accept raw data and perform analysis for numeric criteria exceedances.

4.3.3. Tier I and Non-BURP Compatible Data

4.3.3.1. Number of Data Types

If the Tier I data are not BURP compatible, then DEQ evaluates the number of data types. DEQ policy is to use a minimum of two data types to make listing or delisting decisions. These data types can be physical (e.g., sediment) or biological (e.g., macroinvertebrates). Also, the weight of evidence from these data types should convincingly refute or support the beneficial use determination. See Section 4.4 for guidance on documenting use support determinations using non-BURP compatible data.

A single data type not associated with numeric criteria may be incorporated into other water quality decisions, but is not used solely for 303(d) listing or delisting decisions.

4.3.3.2. Data Analysis and Conclusions

After determining the number of data types, DEQ then ascertains if the data have been analyzed and if conclusions or results were reached. If this information does not accompany the data, then DEQ policy is to not use this data for 303(d) listing determinations. Please note that this policy only pertains to data not associated with numeric criteria. This DEQ policy is based on two important considerations. First, DEQ is concerned about the error rate associated with analyzing someone else's data for listing or delisting decisions. Second, DEQ does not believe it has the time and resources necessary to adequately analyze someone else's data during the 303(d) assessment process. For beneficial use determinations in other water quality decisions, DEQ evaluates the decision to use unanalyzed data based on the available time and resources required in analyzing that data.

4.4. Reconciliation of Conflicting Data Results

Although the assessment process is designed to be comprehensive and accurate in determining impairment status of beneficial uses, there may be times where other data show a different result. Throughout this guidance, DEQ repeatedly states that the assessor has the latitude to change an assessment determination with sound justification. Another situation where the assessor may need to provide justification occurs when using only non-BURP compatible data types.

Sound justification or documentation entails providing convincing evidence for an initial support determination or reconciliation of conflicting data results. The DEQ guidance for this evidence is slightly different depending on the support determination.

If the assessor believes that the determination should be not full support, then the justification should demonstrate the following:

1. Data show measurable and adverse change to the beneficial use;

2. The adverse change is linked to a causative pollutant; and

3. The pollutant is linked to a human-caused action.

If the support determination is believed to be full support, then the assessor should demonstrate the following:

1. Weight of evidence convincingly shows no measurable adverse change to the beneficial use; or

2. Data convincingly show that an adverse change is not due to a causative pollutant; or

3. Data convincingly show that the pollutant is not linked to a human-caused action.

Section 5. Criterion Evaluation and Exceedance Policy

Setting of water quality standards under the Clean Water Act is a state responsibility, subject to EPA oversight. Federal policy allows latitude to the states in interpretation of the standards they develop. This section provides interpretive guidance on certain aspects of both narrative and numeric criteria found in Idaho's water quality rules.

Narrative criteria are often called "free from" criteria as they often contain statements like "waters shall be free from toxics in toxic amounts," and have no quantitative thresholds set in rule. This requires an assessor to make a case-by-case evaluation of whether the narrative is met. Guidance for this evaluation is provided below. Numeric criteria, on the other hand, set quantitative thresholds that apply broadly. While these are much easier to evaluate, the simple "one-size-fits-all" approach does not always fit well with the natural variability of water bodies. As the goal is protection of beneficial uses, Idaho's water quality rules and policy described in this section provide for limited flexibility in determining when exceedance of numeric thresholds is a violation of water quality standards.

This section describes narrative criteria interpretation and numeric criteria implementation, including a 10 percent criteria exceedance policy applicable to conventional pollutants only, Idaho's temperature exemption, allowance for natural background conditions for all pollutants, guidance on determining when and where salmonid spawning occurs for the purpose of applying salmonid spawning criteria, and evaluation of toxics criteria.

5.1. Narrative Criteria Evaluation Policy

Narrative criteria are statements that protect against impairment of beneficial uses by pollutants that have no numeric criteria. The Idaho water quality standards generally state that surface water shall be free from the following materials in concentrations that would result in the impairment of the designated beneficial uses (see WQS 200):

- hazardous materials;
- toxic substances;
- deleterious materials;
- radioactive materials;
- floating, suspended, or submerged matter;

- excess nutrients;
- oxygen-demanding materials; and
- sediment.

DEQ largely relies on its biological metrics for evaluation of narrative criteria (see Section 6). However, it is recognized that there can be clear evidence of narrative criteria being violated in absence of BURP data. For example, a water body may have reports of fish kills or cattle killed from drinking water containing toxic algae. Even though no numeric criterion exists for general toxic substances or nutrients, there is clearly an impairment of beneficial uses.

In the absence of specific criteria, the assessor must use substantiated best professional judgment to determine a violation. Should the assessor determine an impairment has occurred they must provide a documented rationale for their judgement. **This documentation must consider that there is a source of pollution (i.e., anthtropogenic cause), a pathway, and a measurable adverse effect on a beneficial use** (see Section 4)**.** It is recommended that to the extent possible appropriate data be collected to substantiate such determinations.

Most often the assessor will be faced with evaluating Idaho's narrative criteria for nutrients or sediment. These are particularly difficult because they are natural constituents of water and only become controllable problems when elevated above natural amounts. Taking sediment, for example, and applying the guidance of the previous paragraph, there first must be an anthropogenic source of sediment, a road or mass failure attributable to a road or land management activity. Secondly, that source must have delivered sediment as evidenced by current delivery (i.e., mass failure runout ending in a stream channel), recent delivery (i.e., delta or sediment deposits in stream directly traceable to a source), or probable future delivery (i.e., deposition in a draw, dry channel, or ditch leading to a live stream). Thirdly, that sediment delivery must be of sufficient quantity and duration to have resulted in an adverse response in the stream. This is most defensible when the response is directly measurable as an undesirable change in the aquatic life of the stream. It may, however, be possible to use physical changes in the stream which have been previously associated with adverse biological changes to infer a likely adverse effect on a beneficial use. This is a difficult association and must be done on a watershed specific basis; for example see Bauer and Ralph (1999). Such inferences should be followed up with bioassessment.

5.2. Numeric Criteria Evaluation Policy

It is important to understand that water quality conditions vary from place to place (spatial) and from time to time (temporal). This happens because factors such as geology, vegetation, elevation, climate control, and natural or ambient water quality change (EPA 1998). In response to these changes, macroinvertebrates, fish, and algae have evolved with different life histories, physiologies, and mobilities (Pan et al. 2000).

Most surface waters and aquatic organisms have an ability to tolerate or adapt to small exceedances over short time periods for conventional water quality parameters (DO, pH, turbidity, TDG, temperature) without deleterious affects (Carins Jr. 1977, Connel 1978). This concept is embedded in the theories of resistance and resiliency, chronic vs. acute, and the buffering capacity of running waters (Wetzel 1983, Allan 1995). The DEQ exceedance policies attempt to better clarify the occurrence and interpretation of these situations.

Due to natural variability in water quality, variability in translation to a biological response, and possible measurement errors, DEQ does not interpret the numeric criteria for conventional pollutants as a sharp line between impairment and non-impairment. Rather, there is a gray-zone where there may or may not be an impairment.

Because criteria are developed conservatively, DEQ believes this gray-zone falls above the set criteria levels. By policy DEQ thus establishes a zone up to 10 percent criteria exceedance in which the assessor has flexibility to consider other evidence to determine a violation. This numeric criteria evaluation policy of DEQ is consistent with guidance from EPA (EPA 1997) and other states in EPA Region 10 (WDOE 1997). Figure 5-1 provides an overview of the policy.

While this policy deals solely with frequency, DEQ does recognize that magnitude and duration of any criteria exceedance is also important to the biological response and ideally should be considered as well. Magnitude, duration, and frequency are typically not independent of one another. Thus, evaluating frequency alone, while it can have its limitations, is a practical gage of criteria exceedance and one that is supported by national EPA policy.

Our knowledge and understanding of the relationship between pollutant levels and support of beneficial uses can change. Consequently, water quality standards and policies often change from year to year, making it imperative that the most recent standards and policies for specific numeric criteria be used. DEQ has specific policies to interpret different numeric criteria exceedances as discussed below.

5.2.1. Exceedance Policy for Dissolved Oxygen (DO), pH, Turbidity, Total Dissolved Gas (TDG), and Temperature

The intent of this section is to publicly establish the guidelines for determining if a particular set of criteria exceedances has resulted in a water quality impairment and thus, violation of standards. Results above 10 percent exceedance are always considered a violation. Up to and including 10 percent exceedance DEQ may determine a numeric criteria violation for dissolved oxygen, pH, turbidity, total dissolved gas, or temperature if other evidence indicates measurable impairment. A minimum of at least two measurements must be evaluated in any of these parameters before a determination of violation can be made. Figure 5-1 illustrates this process.

In using this policy it is important the assessor consider the period of measurement. To determine meaningful frequencies, the data record should be representative of the entire period when the criteria apply. Because of the seasonal cycle of temperature special consideration is in order.

To evaluate salmonid spawning criteria, temperature data should be collected for at least 45 consecutive days during the spawning and incubation period for the particular salmonid species inhabiting those waters. For cold water aquatic life, temperature data collected over the entire summer (June 22 through Sept. 21) should be used. In addition, the frequencies must be calculated on the metric of interest (e.g., the frequency of daily maximum stream temperature exceeding daily maximum criteria). DEQ has prepared a memo specifically on procedures for calculating frequency of exceedance for temperature (DEQ, 10-23-01, Appendix D). This memo should be consulted by anyone evaluating temperature exceedances.

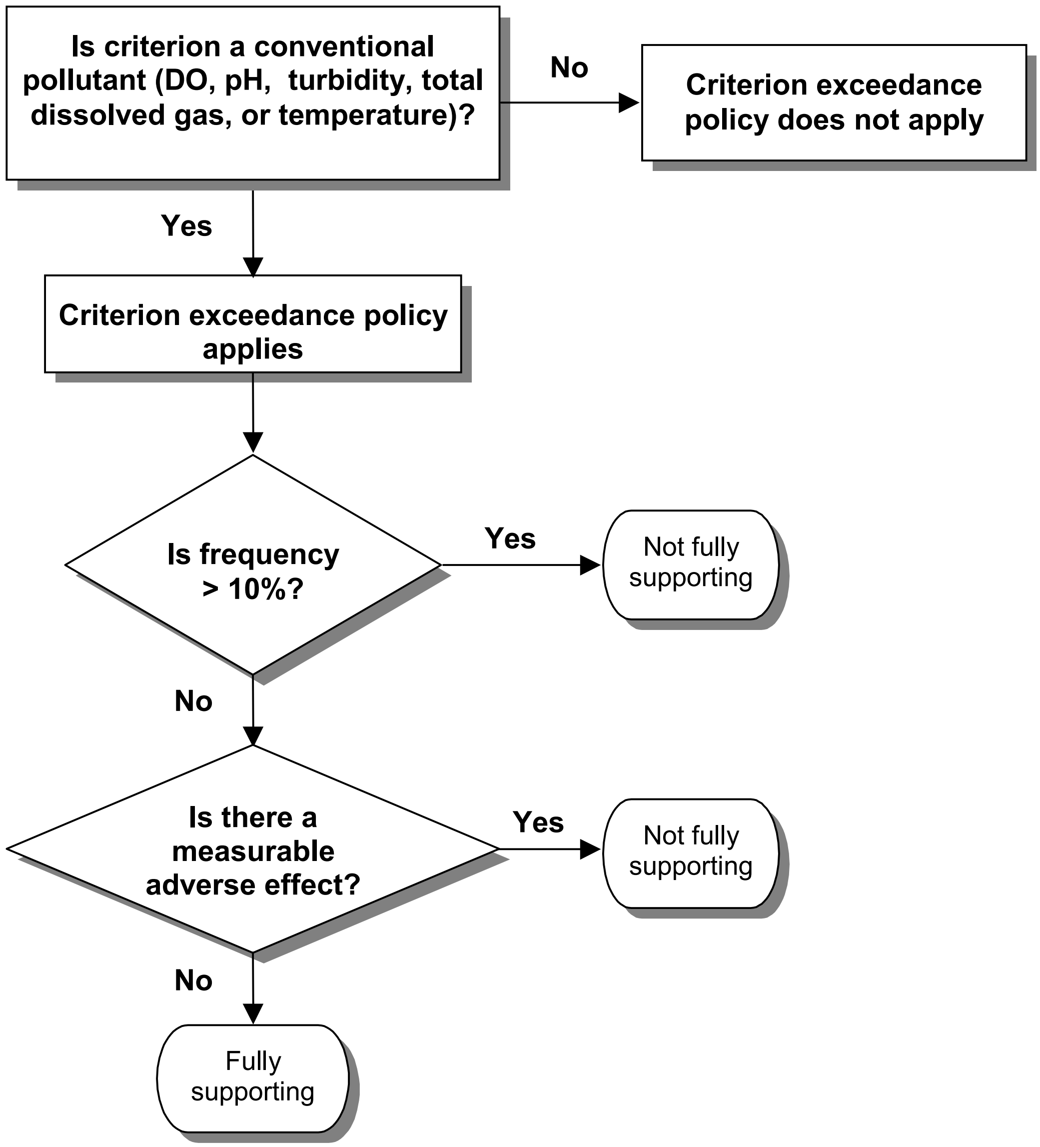


Figure 5-1. Numeric Criterion Exceedance Evaluation for 303(d) Listing

5.2.2. Temperature Exemption

During exceedingly hot weather it is expected stream temperatures will rise also. In some waters this alone can cause temperature to exceed criteria. Thus, Idaho and other agencies acknowledge that when the ambient air temperature is extremely high, exceeding water temperature criteria may not be a standards violation (WQS § 080.04; ODEQ 1995; Coutant 1999; EPA ANPRM).

The Idaho water quality standards define air temperature extremes as any time "... the air temperature exceeds the ninetieth percentile of the seven (7) day average daily maximum air temperature..." (WQS § 080.04). In practice, DEQ will require a minimum of a 10-year period of record to calculate a 90th percentile for applying this rule.

To simplify application of this exemption Strong and Essig (2001) (Appendix E) compiled 30-year air temperature records for weather stations representative of the 10 climate divisions in Idaho set by the National Climatic Data Center. From these records they determined annual seven-day average maximum air temperatures for each station, and then calculated the 90th percentile of these annual maxima over the 30-year period of record. When these 90th percentile values are exceeded at the representative weather station within these climate zones, temperature criteria in the water quality standards do not apply in any water bodies within that climatic zone.

5.2.3. Natural Background

It is possible that exceedances of numeric criteria can occur under natural conditions. For instance, many streams and rivers draining wilderness or minimally disturbed watersheds cannot meet Idaho's current temperature criteria (Bugosh 1999). The Idaho water quality standards state that natural background must be considered in criteria evaluations. Specifically:

> Where natural background conditions exceed any applicable water quality criteria set forth in sections 210, 250, 251, 252, or 253, the applicable water quality criteria shall not apply; instead, pollutant levels shall not exceed the natural background conditions (WQS § 200.09).

DEQ defines natural background conditions to be "no measurable change in the physical, chemical, biological, or radiological conditions existing in a water body without human sources of pollution within the watershed." In evaluating waters for impairment it is desirable to consider whether natural conditions or human sources are the cause. This is often difficult to sort out and typically there is not enough time nor data to fully consider causes when conducting statewide assessments for reporting required by Clean Water Act sections 303(d) or 305(b).

Therefore, the assessor should assume wilderness and other roadless watersheds to be without human sources of pollution and thus *a priori* at natural background condition. Other watersheds with some human disturbance could be determined to exhibit natural conditions for specific pollutants. A watershed assessment, such as prepared in prelude to a TMDL, will be needed for less obvious cases of natural conditions. DEQ will be developing more complete and separate guidance on determination of natural background conditions.

5.2.4. Salmonid Spawning

A subcategory of the criteria for cold water aquatic life use (CW ALUS) is to protect spawning for salmonid fishes (trout, salmon, and whitefish, WQS § 250, 250.02.e). In addition to all other numeric criteria, waters for which salmonid spawning is a designated or existing use additionally have colder temperature criteria, intergravel dissolved oxygen criteria, and water column dissolved oxygen saturation requirements (Table 5-1). These criteria apply in addition to criteria that apply to all waters for which CW ALUS criteria apply (Section 6.4). This discussion focuses on temperature criteria, although much of it is relevant to applying dissolved oxygen criteria as well.

Table 5-1. Cold water aquatic life criteria that change depending whether salmonid spawning is considered a designated or existing use

Characteristic	Cold Water: without salmonid spawning	Cold water: with salmonid spawning
Temperature	19°C daily average, 22°C daily maximum	9°C daily average, 13°C daily maximum
WCDO	6 mg/l minimum	Greater of 6 mg/l and 90% of saturation
IGDO	None	5 mg/l minimum, 7-day average >6 mg/l

WCDO – water column dissolved oxygen; IGDO – intergravel dissolved oxygen

However, application of water quality standards to salmonid spawning waters takes special consideration, because the time frame of their application is species and spawning/incubation period specific. The WQS § 250.02.e reads as follows:

> Salmonid spawning: waters designated for salmonid spawning are to exhibit the following characteristics during the spawning period and incubation for the particular species inhabiting those waters…

Listing all the possible spawning and incubation periods for different species for different areas is beyond the scope of the WQS at § 250.02 or of the WBAG. However, in order to apply criteria, the assessor needs to estimate the applicable time periods. Table 5-2 lists core-time periods when salmonid spawning and egg incubation commonly occur. These time periods may be used as a guide for when to apply salmonid spawning criteria. If more specific information is desired about time periods for when spawning and egg incubation likely occurs for a specific water body or region, assessors are encouraged to use more specific information instead. The information sources used need to be documented in the assessment process. Sources of information might include articles from fisheries journals, reports, or written records of field observations made by fisheries biologists for the locale.

Table 5-2. Common core-periods for spawning and egg incubation for several native and introduced salmonid species that occur in Idaho

Fish Species	(Annually) Time Period	Fish Species	(Annually) Time Period
Chinook salmon (spring/summer)	Aug 15 - June 1	Bull trout	Sept 1 - Apr 1
Chinook salmon (fall)	Oct 1 - Apr 15	Kokanee salmon	Sep 1 - May 1
Sockeye salmon	Oct 1 - June 1	Mountain whitefish	Oct 15 - Mar 15
Steelhead trout	Apr 1 - July 15	Brown trout	Oct 1 - Apr 1
Redband/rainbow trout	Mar 15 - July 15	Brook trout	Oct 1 - June 1
Cutthroat trout	Apr 1 – Jul 1		

Appendix F includes some further considerations for applying criteria and an annotated bibliography of some spawning periods that have been reported for cutthroat trout, *Oncorhynchus mykiss* (i.e., rainbow, redband, or steelhead trout), and Chinook salmon. This bibliography is appended with the hope that it may be useful for those interested in more refined estimates of spawning and incubation periods for the particular species inhabiting the waters of interest.

Assessors are encouraged to estimate spawning and incubation periods with a level of detail appropriate for the assessment purpose. For example, if an assessor is screening over a hundred temperature records for exceedances, Table 5-2 may be sufficiently detailed. If an assessor is examining temperature records from a single watershed or subbasin, and the precision of the estimates are biologically or economically important, a careful literature and records review, convening an expert panel or field surveys might be justified. Assessors may use any reasonable and knowledgeable approach for estimating these time periods, as long as the approach is sufficiently documented so that it could be reconstructed.

Bull trout are directed by regulation to spawn during September and October, so unlike other species, spawning criteria for bull trout waters need to be applied to bull trout waters in September and October regardless of local information (WQS § 250.02.f; 40 CFR 131.33).

Criteria are intended to protect indigenous species; however, the state may, in addition, elect to protect non-indigenous species if the state considers them a desired species. If for a water body, a non-indigenous salmonid species is present and the Idaho Department of Fish and Game (IDFG) considers that species socially desirable for that drainage, then salmonid spawning criteria would be applied for that species. The management objectives of IDFG's Fisheries Management Plans specifies by drainage which species are considered desirable and are managed for propagation and sustainable populations.[2] Species such as rainbow trout have ambiguous origins and occur both as an indigenous species and have been widely stocked within and beyond their historical range. In these cases, fish are considered indigenous if they are

[2] e.g. http://www.state.id.us/fishgame/fishplan.htm

located within the historical range for that species and if they naturally reproduce in the water body.

5.2.5. Bacteria *(E. coli)*

The Idaho water quality standards address frequency for bacteria criteria exceedances in the primary and secondary contact recreation criteria by using triggers or instantaneous criteria for additional sampling. If additional sampling is required, then a geometric means is calculated and interpreted to determine a violation (see Section 6).

5.2.6. Evaluating “Toxics” — Ambient Chemical Water Quality Criteria

Reserved.

Section 6. Aquatic Life Use Support (ALUS) Determination

The strength of the ALUS determination is the use of ecological indicators in water quality assessments. Water quality is evaluated and compared to levels needed for the protection and maintenance of viable communities of aquatic species. Measurements of aquatic assemblages reflect long-term stream conditions more than instantaneous chemical measurements and provide a direct measure of the aquatic life beneficial use.

The aquatic life beneficial use comprises four general subcategories of beneficial uses: cold water, salmonid spawning, seasonal cold water, and warm water. Bioassessment procedures are described in the following sub-sections for cold water and salmonid spawning beneficial uses. Since the multimetric indexes for cold water aquatic life communities were developed from statewide data sets that include sites with both cool and cold water species present, it may be feasible to evaluate waters designated for seasonal cold water aquatic life uses using the cold water assessment procedures. However, reference conditions for seasonal cold waters would likely need to be established. Such an application will require further evaluation and consequently there are no assessment tools for seasonal cold water aquatic life uses. No assessment tools for evaluating warm water biological communities are presently available. DEQ uses both biological indicators and numeric water quality criteria to assess aquatic life use.

6.1. Multimetric Indexes

6.1.1. Multimetric Index Description

To evaluate aquatic life use, DEQ applies multimetric indexes based on rapid bioassessment concepts developed by EPA (Barbour et al. 1999). Measurements of biological, physical habitat, or physicochemical conditions known as metrics comprise the indexes. The indexes include several characteristics to gage overall ecosystem health. The multimetric index value for a sample site is the sum of individual metric scores. Multimetric index scores are unitless, and therefore easily comparable.

The strength of such an approach is the integration of biological, physical, and chemical characteristics of the water body at different scales — individual, population, community, and ecosystem (Karr et al. 1986). This integration allows DEQ to detect water quality impairment cost-effectively and furnishes this information in an understandable format.

Data used to calculate certain indexes, such as the Stream Fish Index, may be limited due to sampling resource requirements, endangered or threatened species sampling restrictions, and sampling protocols incompatible with BURP methods. Therefore, DEQ has developed several bioassessment tools to limit reliance on just one tool and still ensure direct measurements of aquatic life.

6.1.2. Establishing Reference Condition

As part of the multimetric approach, reference sites are used to develop a range of conditions that can be divided into any number of categories indicating different levels of impairment (Barbour et al. 1999). Reference sites are grouped to establish a reference condition, the benchmark used in the assessment process. DEQ compares multimetric index scores of sites to this reference condition to determine use support.

6.1.3. Reference Condition and Water Quality Standards

Idaho Code states that reference streams or conditions shall be selected to represent the land types, land uses, and geophysical features found within the majority of the basins. Reference conditions are to be representative of either 1) natural conditions with few impacts from human activities, or 2) minimum conditions needed to fully support the designated uses (IC § 39-3606, WQS 003.085).

This direction is reflected in the DEQ assessment process. DEQ estimates reference condition by screening stream and river sampling sites and identifying those with few impacts from human activities. In terms of water quality standards, these sites are similar to the "highest level of support attainable in the basin" (WQS § 003.85). Also, DEQ organizes sampling locations into reasonably comparable groups based on factors like land type, land uses, geophysical features, climate, and size of the water body (see IC § 39-3606). If the water body in question has similar physical, chemical, or biological measures to those found at the reference condition, then the water body is considered to be "fully supporting" its beneficial use (IC § 39-3606).

6.1.4. Reference Condition and Hydrologically Modified Waters

Based on the body of research leading to this assessment process, DEQ believes that most streams and rivers have the capacity for their biological and habitat parameters to measure within the ranges of comparable reference conditions. For most waters, if point or nonpoint pollution sources were managed, then biological and habitat parameters could be expected to be within the range of natural variability for reference conditions.

However, hydrologic modifications such as dams or diversions have fundamentally altered some streams and rivers from their original conditions, and their biological and physical conditions likewise have been fundamentally altered from their historical conditions. An obvious example is the conversion of a river to a reservoir. As aquatic conditions are changed from river to reservoir, conditions that favor trout and other fish adapted to cold-swift waters are shifted to pond-like conditions that favor warm water fishes, largely introduced from the Midwest, such as large and smallmouth bass, carp, crappy, and catfish (Li et al. 1987). These species may be considered desirable and represent “fishable” aquatic life and recreational beneficial uses. In another example, historically anadromous salmon inhabitated the Snake River basin upstream to natural barrier waterfalls (e.g. Shoshone Falls, Malad Falls). Impassible dams and reservoirs (e.g., Dworshak Dam blocking the North Fork Clearwater River or the Hells Canyon dam complex blocking the Payette, Boise, and mid-Snake systems) make it unrealistic to expect the presence of steelhead trout or salmon in the rivers upstream of these hydrological modifications.

With this in mind, DEQ believes that pervasively hydromodified systems should not be compared to unregulated rivers. Certain conditions may be presently unattainable if the dams, diversions, or other hydrological modifications are operated for the purpose for which they were constructed. DEQ will base the beneficial use assessment on those minimum conditions needed to fully support the designated uses of these fundamentally modified systems. These minimum conditions will be determined on a case-by-case basis to protect their “fishable” beneficial uses.

6.2. Technical Support Documents

The development of multimetric indexes relevant to Idaho beneficial uses is a substantial research effort. Several years of data collection and extensive technical analyses provide the basis for use of these bioassessment tools in the assessment process. The specifics of these analyses are beyond the scope of this guidance; however, DEQ does provide this information in the *Idaho Stream Ecological Assessment Framework* (Grafe 2002b) and *Idaho River Ecological Assessment Framework* (Grafe 2002c) if the reader seeks more details regarding the development of the cold water aquatic life bioassessment tools. For convenience, brief summaries of the principle components of these assessment tools are found in Appendixes H and I of this document.

6.3. Water Body Size Determination

The WBAG uses water body size criteria to distinguish between two classes of flowing water: streams and rivers. This distinction is important since DEQ uses different bioassessment indexes to assess the aquatic life support use of these two classes. Section 2 of this document describes the method used to determine water body size. For more details regarding the development of this method, please refer to Grafe 2002a.

6.4. Aquatic Life Use Support Determination — Cold Water Aquatic Life

6.4.1. Stream Index Scoring

DEQ uses BURP-compatible data to calculate the Stream Macroinvertebrate Index (SMI), Stream Fish Index (SFI), and Stream Habitat Index (SHI). The results of these indexes are used to evaluate support of cold water aquatic life. DEQ may also use physicochemical data to identify numeric criteria exceedances of water quality standards (see Section 5.2.) and/or other available data to support or modify assessment interpretations (see Section 4.3.).

6.4.1.1. Stream Macroinvertebrate Index

The SMI is a direct biological measure of cold water aquatic life. The details of the SMI development and supporting analysis may be found in Jessup and Gerritsen (2000). Additionally, Appendix H of this document provides a brief summary of the classifications and metrics for this index.

DEQ uses a scoring approach similar to methods recommended in the *Rapid Bioassessment Protocols* (Barbour et al. 1999). The scoring criteria are derived from percentile categories of the reference condition. Figure 6-1 provides an example of the scoring approach for the SMI in the Central and Southern Mountains bioregion (see Table 6-1 for scoring criteria of this bioregion).

DEQ based the breakpoints for the SMI condition ratings on two tests: discrimination efficiencies and Type I/II errors. First, DEQ analyzed the reference and impaired SMI data set to determine where there was a balance of Type I (i.e., unimpaired stream, but WBAGII determines it impaired) and Type II (i.e., impaired stream, but WBAGII determines it unimpaired) errors. DEQ found this balance of error generally occurred for all the bioregions at the 10^{th} percentile.

Next, DEQ evaluated the discrimination efficiencies of the SMI data set. The discrimination efficiency (DE) is the percent of disturbed sites with SMI scores less than a particular reference percentile score. Because an objective was to have a balance of Type I and II errors, DEQ first evaluated the DE at the 10^{th} percentile and found results ranging from 85 to 88 percent for all the bioregions. This means that approximately 85 percent of the impaired sites were correctly identified at the 10^{th} percentile of reference condition. DEQ believes that about 80 percent is an acceptable DE to distinguish impairment and consequently, assigned the condition rating of 2 at the 10^{th} percentile.

To assign the condition rating of 3, DEQ evaluated the DE at the 25^{th} percentile and observed results ranging from 90 to 97 percent. DEQ believes about 90 percent is an appropriate level to assign the higher condition rating of 3.

At first glance, the use of the 10^{th} and 25^{th} percentiles may appear to be a low standard. However, it is important to remember that the comparison is to *reference condition*. The reference condition is based on a group of sites that are considered minimally disturbed for that bioregion.

Below the minimum of reference condition is identified as a minimum threshold. The purpose of a minimum threshold is to identify significant impairment that may not be apparent after data index integration. DEQ uses this as a signal from individual indexes to ensure protection of cold water aquatic life. DEQ concludes not fully supporting if a water body has even one index result below a minimum threshold.

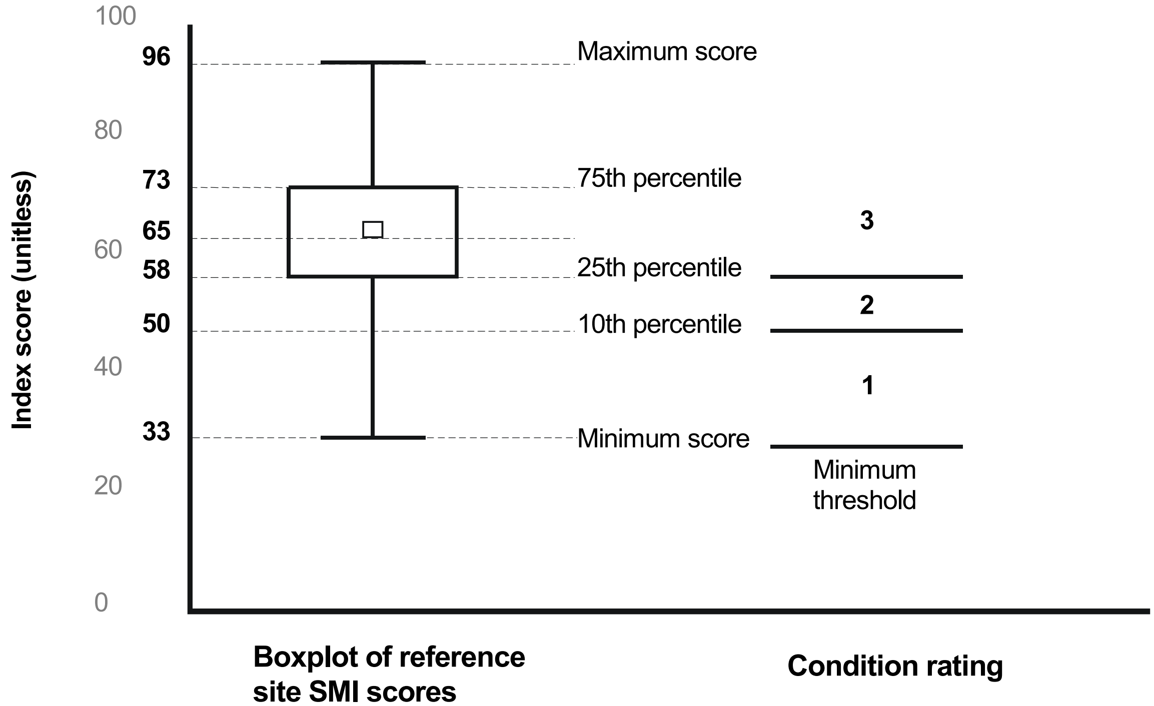


Figure 6-1. Example of Multimetric Scoring Method for the SMI in the Central and Southern Mountains Bioregion

This scoring approach uses percentile categories of only the identified reference sites that comprise the reference condition. The box plot above depicts the distribution of reference site scores.

Each condition category is assigned a rating of 1, 2, or 3 (see Figure 6-1). This rating assignment allows DEQ to effectively integrate multiple index results into one score. The final score derived from these multiple data sets is then used to determine use support. Table 6-1 summarizes the scoring criteria for the SMI. The scoring criteria are assigned according to each bioregion reference condition. Bioregions are divided into Northern Mountains, Central and Southern Mountains, and basins.

Table 6-1. SMI Bioregion Scoring Criteria*

	Bioregion Classification			
Condition Category	**Northern Mountains**	**Central and Southern Mountains**	**Basins**	**Condition Rating**
Above the 25th percentile of reference condition	≥65	≥59	≥51	3
10th to 25th percentile of reference condition	57 – 64	51 – 58	43 – 50	2
Minimum to 10th percentile of reference condition	39 – 56	33 – 50	33 – 42	1
Below minimum of reference condition	<39	<33	<33	Minimum Threshold

*Scoring for all the indexes is rounded to the nearest whole number.

6.4.1.2. Stream Fish Index

The SFI is also a direct biological measure of cold water aquatic life. The details of the SFI development and supporting analysis may be found in Mebane (2002a). For a brief summary of the classifications and metrics for this index, please refer to Appendix H of this document.

DEQ uses a similar scoring approach to that used for the SMI. However, the breakpoints for condition ratings are different based on analyses of DEs and Type I/II errors. DEQ found the balance of error occurred for both the rangeland and forest streams at the 25th percentile. The DEs at this percentile were 78 and 74 percent for forest and rangeland, respectively. Consequently, DEQ assigned the condition rating of 2 at the 25th percentile. The DEs at the median of reference condition were 88 and 92 percent for forest and rangeland, respectively, so DEQ assigned the condition rating of 3 at this level. Below the 5th percentile of reference condition was identified as a minimum threshold. Table 6-2 summarizes the scoring criteria for the SFI for each bioregion.

Table 6-2. SFI Bioregion Scoring Criteria

	Bioregion		
Condition Category	**Rangeland**	**Forest**	**Condition Rating**
Above the median of reference condition	≥82	≥81	3
25th percentile to median of reference condition	62 – 81	67 – 80	2
5th to 25th percentile of reference condition	39 – 61	34 – 66	1
Below 5th percentile of reference condition	<39	<34	Minimum Threshold

6.4.1.3. Stream Habitat Index

The details of the SHI development and supporting analysis may be found in Fore and Bollman (2000). A summary of the SHI metrics is provided in Appendix H of this document.

Although fundamentally the SHI scoring system is based on similar concepts used for the other indexes, DEQ does not use a minimum threshold for this index. This is different from the SMI and SFI for two reasons. First, and most importantly, Fore and Bollman (2000) and Bauer and Ralph (1999 and 2000) reported significant variability among physical habitat measures. Although DEQ believes physical habitat is a useful interpretive tool, the agency is cautious about using the SHI solely to determine aquatic life use support. Second, the SHI comprises non-biological components and consequently, is not a direct measure of the aquatic life use.

DEQ did use the SMI reference and impaired data set to generate a scoring system for each SHI ecoregion. Using DEs and Type I/II error analyses for the SHI, DEQ found the balance of error generally occurred for all the ecoregions at the 10th percentile. The DEs were extremely high at this percentile ranging from 92 to 100 percent. Consequently, DEQ assigned the condition ratings of 2 at the 10th percentile and 3 at the 25th percentile. Table 6-3 summarizes the scoring criteria for the SHI.

Table 6-3. SHI Scoring Criteria.

Condition Category	Northern Rockies	Northern Basin and Range	Snake River Basin/ High Desert	Condition Rating
Above 25th percentile of reference condition	≥66	≥63	≥58	3
10th to 25th percentile of reference condition	58 – 65	50 – 62	55 – 57	2
Below 10th percentile of reference condition	<58	<50	<55	1

6.4.2. River Index Scoring

6.4.2.1. Biological and Physicochemical Indexes

DEQ uses BURP-compatible data to calculate the River Macroinvertebrate Index (RMI), River Fish Index (RFI), and River Diatom Index (RDI). The results from these indexes are used to evaluate support use of cold water aquatic life in rivers. DEQ may also use physicochemical data to identify numeric criteria violations of water quality standards (see Section 5) and/or other available data to support or modify assessment interpretations (see Section 4).

The RMI, RFI, and RDI are direct biological measures of cold water aquatic life. The details of index development and supporting analyses may be found in Royer and Mebane (2000), Mebane (2002b), Fore and Grafe (2000), and Brandt (2002). Appendix I of this document provides brief summaries of the metrics used in these indexes.

Scoring methods used for the river biological indexes differ according to the techniques used to develop the indexes. The RMI and RFI used reference condition approaches similar to those methods used in the development of the SMI and SFI. The developers of the RMI and RDI did not adjust index scores to a 100-point scale. Therefore, the maximum score of these indexes are the highest scores of the individual metrics comprising the indexes. However, the RFI is based on a 100-point scale.

Both the RMI and RFI base condition categories on the 25th percentile of reference condition, which is considered adequately conservative in identifying sites in good condition (Jessup and Gerritsen 2000). DEQ applies the authors' recommendations when identifying additional condition categories. For the RFI, DEQ uses the median and 5th percentiles; below the 5th percentile is distinguished as a minimum (Mebane 2002b). For the RMI, Royer and Minshall (1996) recommended the minimum score of the reference condition to distinguish additional condition categories. DEQ evaluated the range in each condition category of the RMI and then linearly extended the range to identify a minimum threshold.

The development of the RDI scores were based upon the distribution of the entire data set rather than just reference sites, due to the limited number of reference sites. Fore and Grafe (2000) recommend scores assigned to the different index categories based on the 75th, 50th, and 25th percentiles. Fore and Grafe (2000) did not have supporting analysis to recommend a minimum threshold.

Although the RPI is not used in the river data integration process, the index results may still be used in water quality interpretations and decisions other than 303(d). The RPI uses a scoring classification approach based on the development methods of the Oregon Water Quality Index (Cude, in press), the index on which the RPI is based. Standard deviation was used to identify the different index categories of expected condition.

In addition to different indexes, the stream and river bioassessment approaches use different classification methods. The stream approach uses an ecoregion or a grouping of ecoregions into bioregions to classify similar water bodies before applying a scoring system. The developers of the river bioassessment tools did not apply this classification step into the scoring system for several reasons. First, Fore and Grafe (2000) initially grouped test data sets by ecoregional groupings; however, they found no differences in scoring results. Second, large rivers often transcend geological and ecoregional changes making application of distinct classifications difficult. Finally, there are significantly fewer large rivers in Idaho resulting in much smaller test data sets than streams. If the small test sets were further reduced for classification purposes, the analysis would lose considerable scientific rigor.

Similar to the stream cold water aquatic life approach, each condition category is assigned a rating of 1, 2, or 3. This rating assignment allows DEQ to effectively integrate multiple index results into one score. The final score derived from these multiple data sets is then used to determine use support. Table 6-4 summarizes the scoring and rating categories for the RMI, RDI, RFI, and RPI. It should be noted that the RPI scoring criteria is provided for information only. This index is not directly used in the river data integration process. However, the RPI results may be used for supplement water quality interpretations.

Table 6-4. RMI, RDI, RFI, and RPI Scoring and Rating Categories

Index	Minimum Threshold	1	2	3
RMI	<11	11 – 13	14 – 16	>16
RDI	NA[1]	<22	22 – 33	>34
RFI	<54	54-69	70-75	>75
RPI	<40	40 – 70	70 – 80	>80

[1] Fore and Grafe (2000) did not identify a minimum threshold category.

6.4.3. Index Data Integration Approach and Use Support Determination for Rivers and Streams

DEQ applies the index integration approach to determine aquatic life use support. However, as mentioned previously, DEQ may use physicochemical data to identify numeric criteria violations of water quality standards (see Section 5) and/or other available data to support or modify assessment interpretations (see Section 4). To use the multiple index integration approach, all data must be BURP-compatible and meet Tier I criteria (see Section 4).

DEQ believes that water bodies require an integration of multiple data types to assess ecosystem health. With this in mind, DEQ does not use any one piece of evidence to solely assess aquatic life use support. The multiple data integration approach is applied according to available data during the assessment process. If there are not enough data types to calculate two different indexes, then the water body is not assessed until more data are gathered or other Tier I data can be used according to policies described in Section 4. Figure 6-2 illustrates the process of applying this approach.

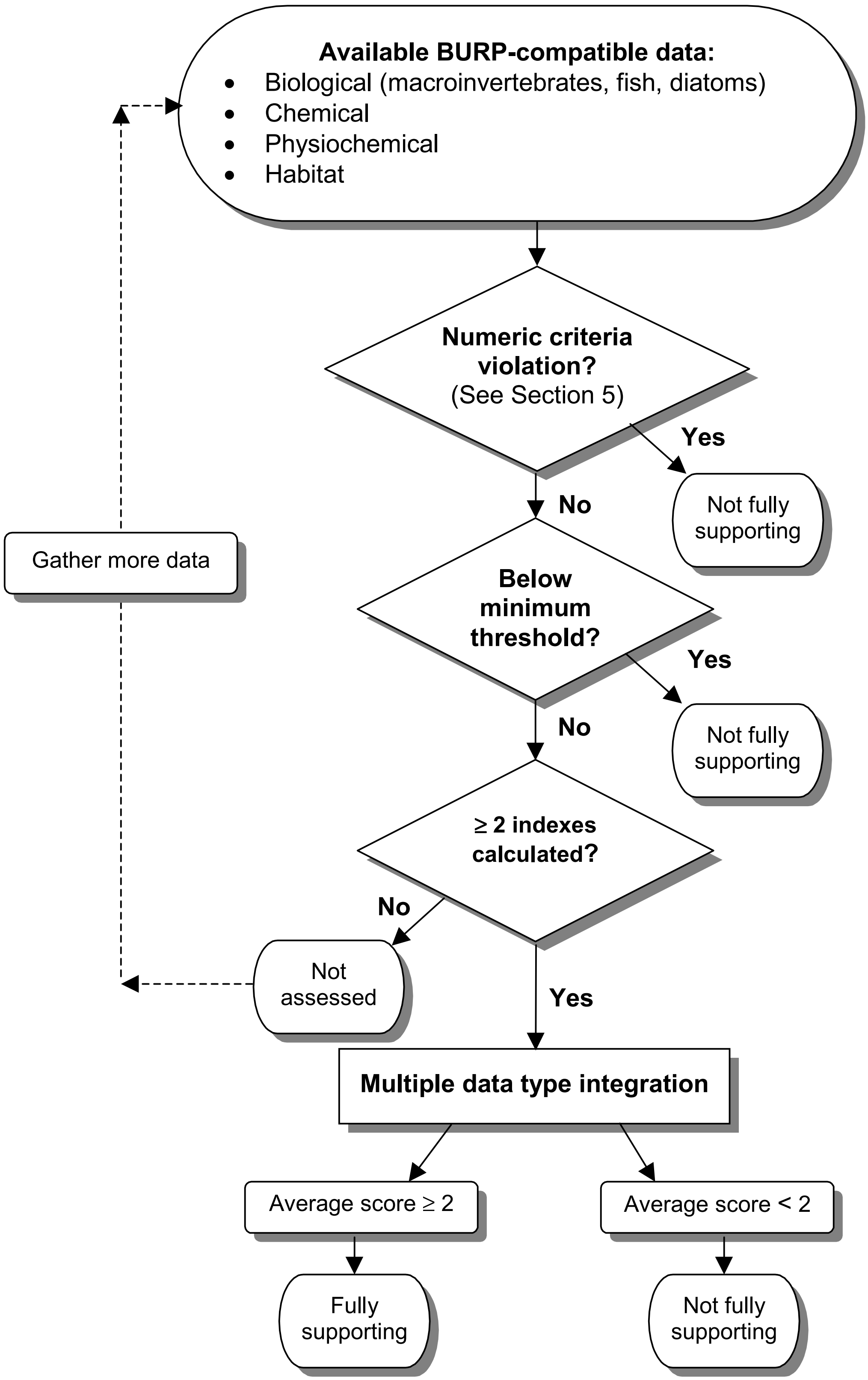


Figure 6-2. ALUS Preliminary Cold Water Aquatic Life Use Support Determination

The data integration approach uses the following steps to determine use support of cold water aquatic life for streams and rivers.

Step 1
Identify any numerical water quality standard violation as determined by using the criterion evaluation and exceedance policy (see Section 5).

If there is a numeric criteria violation, then DEQ automatically determines the water body is not fully supporting.

Step 2
Calculate the index scores and determine if there are at least two indexes.

If there are less than two indexes, then the water body is not assessed unless other Tier I data is available (see Section 4.3.). Additional data should be gathered.

Step 3
Identify any index scores below the minimum threshold levels.

If there are any scores below minimum threshold levels, then DEQ automatically determines the water body is not fully supporting.

Step 4
Identify corresponding 1, 2, or 3 condition ratings for each index.

Step 5
Average the index ratings to determine the use support. To average the individual index ratings, sum the ratings and divide by the number of indexes used.

An average score of greater than or equal to 2 is considered fully supporting.
An average score of less than 2 is considered not fully supporting.

Step 6
Review these preliminary, quantitative results to ensure that they meet logical expectations and data requirements. If not, re-evaluate the data and provide sound justification for support status ratings/assignments different from the indication of the quantitative results (see Section 4.3.).

6.5. Aquatic Life Use Support Determination – Salmonid Spawning

The Idaho water quality standards require that waters designated for salmonid spawning be protected if they "provide or could provide a habitat for active, self-propagating populations of salmonid fishes" (WQS § 100.01b). To evaluate salmonid spawning within the context of the ALUS determination, DEQ must first interpret the regulatory intent of the water quality standards and EPA guidance. DEQ then applies an assessment approach that meets this intent and is workable based on current science and available resources. This approach is applied similarly to small streams and rivers.

6.5.1. Regulatory Interpretation of Salmonid Spawning Use Support

In interpreting regulatory requirements, DEQ considered regulatory definitions, guidance, and numeric criteria. The water quality standards define salmonid spawning as a sub-category of the aquatic life beneficial use (WQS § 100). EPA guidance directly addresses aquatic life use bioassessment, but does not separate bioassessment of salmonid spawning or other sub-categories of aquatic life use (EPA 1994; EPA 1997). This regulatory structure and guidance implies that salmonid spawning is a part of the overall aquatic life use support determination.

Additionally, the definition of salmonid spawning states "habitat" should be protected for salmonid fish. Salmonid spawning generally requires habitat that contains well-oxygenated gravel substrate and cold water for egg incubation. The Idaho water quality standards address these requirements through numeric criteria specific to salmonid spawning (WQS § 250.02.e). Intergravel dissolved oxygen, water temperature, and ammonia salmonid spawning criteria are different from cold water aquatic life criteria. Consequently, DEQ considers numeric criteria for salmonid spawning separately from cold water aquatic life.

6.5.2. Assessment Approach

Since 1996, DEQ has developed and improved the bioassessment tools used in the ALUS determination. For instance, DEQ has developed quantitative fish indexes (SFI and RFI) that incorporate direct measurements of healthy fish communities. These indexes are a significant improvement over the former qualitative approach—the Reconnaissance Index of Biotic Integrity (DEQ 1996). Also, DEQ has revised the habitat index (SHI) to better reflect conditions affecting aquatic condition. DEQ applies a scientifically defensible approach, which, depending on water body size (see Section 2), uses a combination of different biological indexes (fish, macroinvertebrates, and diatoms) as well as physical habitat and physicochemical information. This approach is more robust than that used in the previous WBAG (DEQ 1996).

In light of these bioassessment developments and interpretations of regulatory intent, DEQ believes it is reasonable to evaluate salmonid spawning within the context of the ALUS determination and applicable numeric criteria. Such a process considers the ecological health of fish communities and addresses numeric criteria specific to salmonid spawning. This approach applies similarly to streams and rivers (Figure 6-3). Nationally, this approach seems consistent to methods used by many other states (EPA 1997; EPA 2000). The following steps summarize this approach.

Step 1.
Determine ALUS using appropriate aquatic life numeric criteria and applicable multimetric indexes for streams or rivers (see Section 6.5).

> If ALUS = not fully supporting, then salmonid spawning is not fully supporting.
>
> If ALUS = fully supporting, then continue to Step 2.

Step 2.
Determine if readily available data exist to apply appropriate numeric criteria (intergravel dissolved oxygen, water temperature, and ammonia criteria) specific to salmonid spawning (WQS § 250.02.e).

> If appropriate data do not exist, then salmonid spawning is assumed to be fully supporting based on ALUS = fully supporting.
>
> If appropriate data do exist, then continue to Step 3.

Step 3.
Do data indicate violations (see Section 5) of numeric criteria (intergravel dissolved oxygen, water temperature, and ammonia criteria) specific to salmonid spawning (WQS § 250.02.e)?

> If numeric criteria is violated (see Section 5), then salmonid spawning is not fully supporting.
>
> If numeric criteria is not violated or does not indicate measurable impairment (see Section 5), then salmonid spawning is fully supporting.

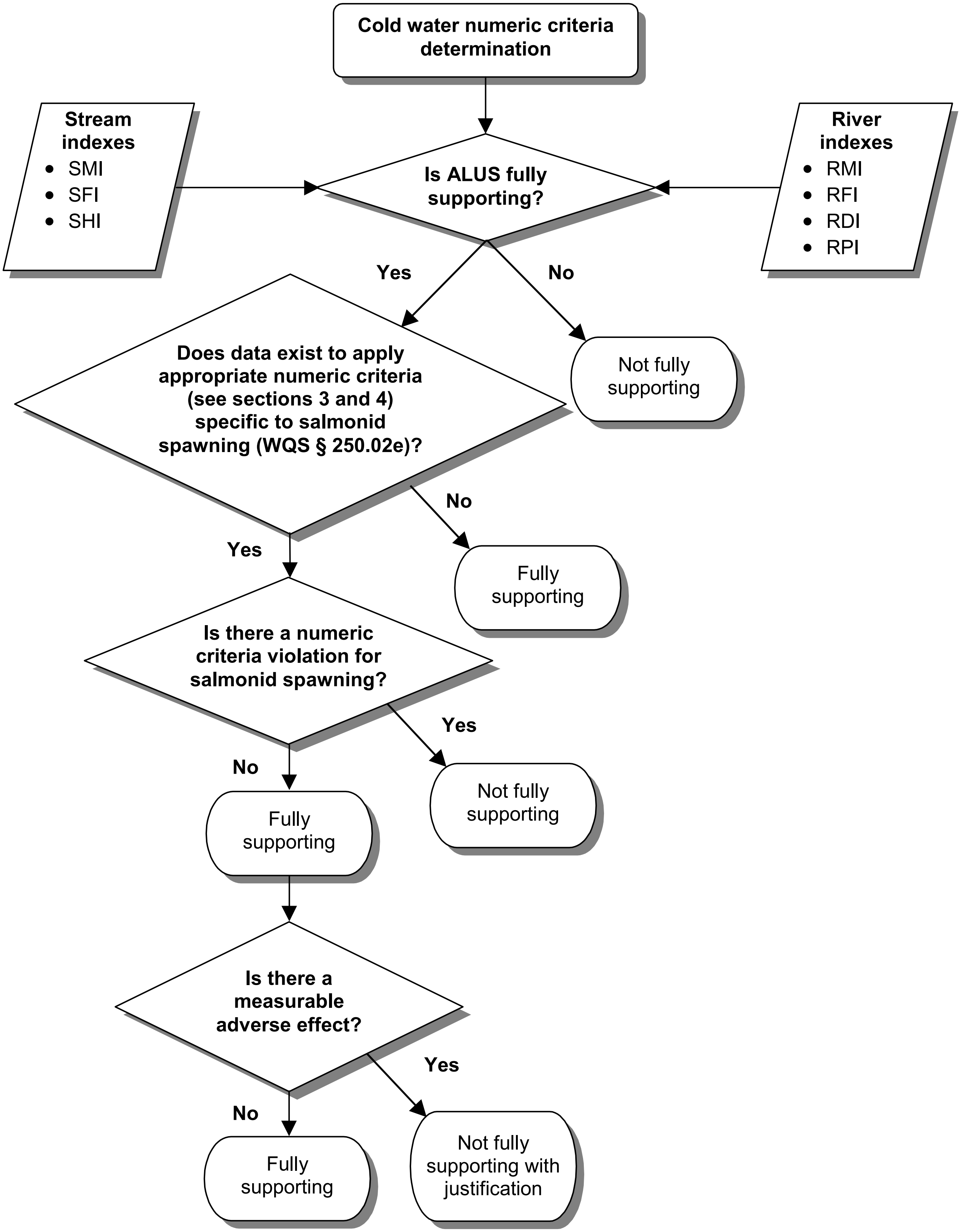


Figure 6-3. Salmonid Spawning Use Support Determination

6.5.3. Use of Outside Data

Although DEQ collects electrofishing data for streams, the agency depends heavily on fisheries data collected from other entities. This is particularly true for large rivers, since DEQ does not routinely collect fisheries data. Additionally, DEQ collection of fisheries data continues to be limited due to endangered or threatened species. With this in mind, it is particularly important for the assessor to locate BURP-compatible fisheries data collected outside DEQ for the SFI and RFI calculations and subsequent ALUS determinations. It is also important for the assessor to coordinate with fish management agencies, such as IDFG, when evaluating salmonid spawning.

6.5.4. Approach Rationale

Alternate approaches that DEQ considered using included assessing salmonid population status, habitat suitability, and various combinations (Grafe and Mebane 2000; Mebane 2000). We considered alternatives for determining whether salmonid populations in a water body were self-sustaining. These alternatives would assess whether a population was self-sustaining using combinations of minimum population size to avoid the risk of extinction in 100 years (Hoelscher 2000), minimum inter-connected patch size or stream miles, and number of age classes. Habitat suitability alternatives included assessing substrate quality, assessing salmonid spawning-specific habitat measures, and using the SHI (Grafe and Mebane 2000; Hoelscher 2000).

DEQ decided not to further develop these alternatives based on concerns of “mission creep” and the belief that the overall ALUS process provides a holistic estimate of the water body’s ecological condition. The “mission creep” concern involves the complex undertaking by DEQ, depending upon the carrying capacity of the specific water body, of defining whether a salmonid population is self-sustaining. Such an undertaking seems more appropriate in the realm of fish and wildlife management agencies, such as the IDFG, U.S. Fish and Wildlife Service, or researchers such as the U.S. Forest Service Rocky Mountain Research Station.

With regards to habitat suitability alternatives, the SHI is a broad index of aquatic and riparian physical habitat measures which were correlated with macroinvertebrate and fish assemblage metrics (Fore and Bollman 2000). However, the index was not specifically developed to assess salmonid spawning and incubation, nor has it been validated for that purpose (Fore 2000). As found by Maret et al. (1993), field measures to assess habitat suitability for salmonid spawning and incubation can be far too labor-intensive to apply at a statewide scale.

The current ALUS process is a fairly complex process by itself. The labor, contractual, and other costs to attempt to resolve and measure the habitat and population sustainability issues have been significant. DEQ chose the current method because it best meets the intent of the Idaho water quality standards, is consistent with other state approaches, and is workable given present scientific tools and available resources.

6.6. ALUS Approach and Legal Requirements

The Idaho Code and administrative water quality standards provide direction for aquatic life use determination and monitoring waters to conduct beneficial use attainability and status surveys. Idaho water quality standards state that aquatic life communities are “beneficial uses” of waters and that where attainable, desirable aquatic species of aquatic life communities be maintained or restored (WQS § 050.02). DEQ approaches to determine whether aquatic life beneficial uses are attained include, but are not limited to, comparing biological and habitat parameters in the stream or water body of interest with those found in reference streams or conditions. DEQ considers whether all water quality standards are met and whether a healthy, balanced, biological community is present (WQS §§ 003.040, 003.85, 053).

The cold water aquatic life assessment process follows guidance from Idaho water quality standards and Idaho Code (Table 6-5). The Idaho water quality standards state that DEQ shall use biological and aquatic habitat parameters listed below and in the current version of the WBAG. These parameters may include, but are not limited to those listed in Table 6-5.

Table 6-5. Comparison of aquatic habitat and biological parameters listed in Idaho Water Quality Standards or Idaho Code, and corresponding indexes used in the cold water aquatic life use support determination.

Indicator	**Water Quality Standards** (WQS § 053, IC 39-3607)	**ALUS Tools**
Aquatic Habitat	Stream width and depth, shade, sediment impacts, bank stability, and water flows	SHI
Biological – Aquatic Macroinvertebrates	Evaluation of Ephemeroptera, Plecoptera, and Trichoptera, Hilsenhoff Biotic Index, and functional feeding groups	SMI, RMI
Biological – Fish	Number and variety of fish to determine community functionality and diversity	SFI, RFI
Biological – Algae	… or other aquatic life	RDI

The actual parameters selected for use in the aquatic life use support determination depended upon their supporting scientific analyses. For example, the SMI includes all the parameters listed in the water quality standards (Table 6-5), plus parameters of richness and pollution tolerance. The SFI includes number of coldwater fish, diversity of ages of fish, and variety of native species among other parameters that distinguished between reference and disturbed sites. Appendixes H and I provide summaries of the stream and river indexes.